PUBLIC WORKS

city county and state

december 1948

some of the articles in this issue:

The Most Useful County Road Equipment
By 247 County Engineers

Studies of Sewage Lagoons in Texas

Cleveland's Filtered Water Reservoir and Temporary Pumping Station

A Trailer Camp for Veterans

Solving Problems in Bridge Building

Modernized Sewer Maintenance

Rebuilding a Water Filter—Step by Step Procedure

Water Quality Criteria

Public Works Up-to-Date Article Digests

Leaders in the Public Works Field

Col. Willard F. Rockwell

Incoming president of the Water and Sewage Works Manufacturers' Association, to which he has contributed greatly. Soldier and leader in industry, Col. Rockwell is Chairman of the Board of Rockwell Manufacturing Co. of Pittsburgh.

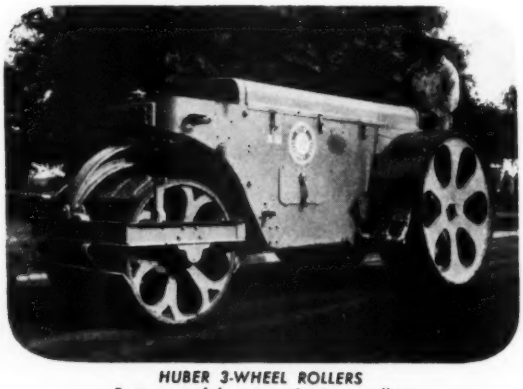
A Smart Move

change to HUBER ROAD MACHINERY

HUBER MAINTAINER
Easily converted to a bulldozer, lift-loader, patch roller, highway mower, berm leveler, snow plow, or rotary broom.

Now is the logical time to ready your organization and equipment for the long construction grind ahead. Realize new profits next year by turning to Huber road machinery. It's a move that will save you time and money, because Huber machinery is built for speedy operation with plenty of power and stamina to assure longer years of trouble-free service. See your Huber distributor today and let him show you the important features that are built into each Huber machine.

HUBER TANDEM ROLLER
Variable weights in three models from 3 to 14 tons.

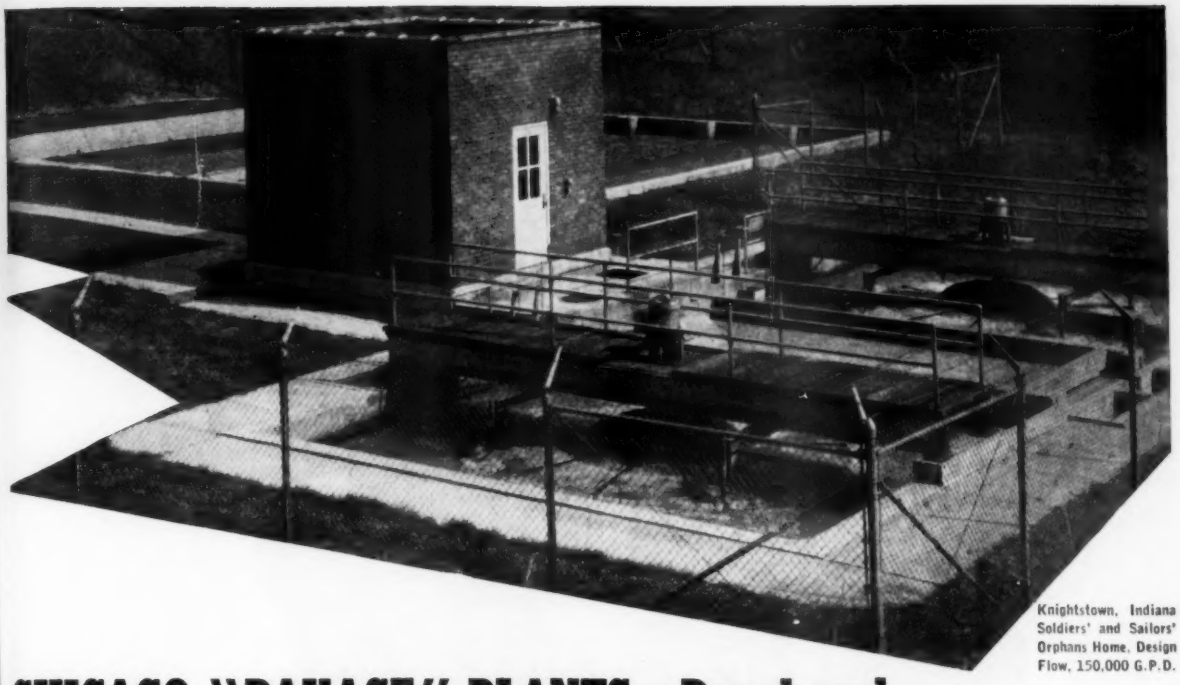


HUBER 3-WHEEL ROLLERS
Fast, powerful, automotive type rollers built in sizes from 5 to 12 tons.

THE HUBER MFG. COMPANY • MARION, OHIO, U. S. A.

HUBER

3 Wheel • Tandem ROAD ROLLERS and MAINTAINERS



Knightstown, Indiana Soldiers' and Sailors' Orphans Home. Design Flow, 150,000 G.P.D.

CHICAGO "PAKAGE" PLANTS—Developed for Small Communities, Industrial Plants, Institutions

"Pakage" Plants require a minimum of operating supervision, produce a sparkling clear effluent, are free from flies, foul odors, and unsightly appearance. Can be located near dwelling.

Initial cost is low. Operating costs are nominal.

Local Operators without previous sewage treatment experience successfully operate these plants. Former farmers, salesmen, coal-miners, truck-drivers are operating existing plants and performing other municipal duties.

Operator training service by Chicago Operating Sanitary Engineers is provided with each plant. Ingenious automatic features of Chicago "Pakage" plants simplify operation and assure successful performance.

Aeration and clarification are performed in a single tank with positive, automatic sludge control. One sludge setting covers a wide range of sewage flows and strengths.

Since 1934 over 200 plants have been installed and are successfully operating.

Properly designed, these units can handle industrial, cannery and other wastes as well as the usual community sewage.

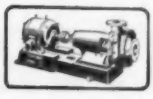
The "Pakage" plant was specifically developed for small populations and can be engineered to meet requirements. Complete literature available.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2348 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers,



Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

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DECEMBER, 1948

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PUBLIC WORKS

The engineering authority in the city-county field

Founded in 1896

Edited by
W. A. HARDENBERGH and A. PRESCOTT FOLWELL

DECEMBER, 1948

HIGHWAYS, AIRPORTS AND CONSTRUCTION

SEWERAGE AND REFUSE

WATER SUPPLY AND PURIFICATION

MISCELLANEOUS

Index of Advertisers—Page 76

STOP THIS ROT!

Banox stops the slush-caused rusting out of car and truck bodies, gratings, bridges and other steel construction in street and highway systems, during the winter months.

Some people blame the abrasive action of sand or the acidity of cinders used on icy streets. Others blame the salt or calcium chloride used for ice melting. Whatever the cause, you can now keep traffic moving on ice-free streets and at the same time reduce the corrosive effects of the slush in your streets far below its "normal" level.

Banox makes *any* slush—from pure water up to the most heavily saturated brines—virtually non-corrosive. Banox makes motorists and municipal officials happy. It costs very little and saves the taxpayers a lot!

For full information, write to Calgon, Inc. Our representative will furnish samples of Banox and steel test strips for you to run your own simple, conclusive tests.

BANOX IN BRIEF

- ★ Works in *any* type of slush
- ★ One pound treats 100 pounds of salt or calcium chloride
- ★ Protection lasts through later thaws and rains
- ★ Odorless and harmless to skin, eyes, clothing, plants, trees
- ★ Can't harm paint, automobile finishes or tires
- ★ Protects *both* rusted and exposed metal surfaces
- ★ Costs about 2¢ per capita per year

HAGAN HALL BUROMIN CALGON

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING PITTSBURGH 30, PA.

The Editor's Page

1949

The staff of PUBLIC WORKS wishes for its readers the best of everything for 1949—a Merry Christmas to end the old year, and a Happy and Prosperous New Year.

Yet wishes alone cannot be relied on to produce needed improvements in the status of engineers. In the long run, and for the bulk of engineers, the attainment of a truly professional status would perhaps be most beneficial. The trends toward placing the engineer in the technician class, so marked since the end of the war and so unfortunate in its effects on many engineers in public service, must be combated. Though by no means the only problem, this is a major one, and worthy of concentrated effort, for on its solution depends largely the future standing, status and compensation of engineers. We shall continue to do everything we can toward the accomplishment of this objective.

I've Had Enough

At the urging of the Medical Department, Congress in 1946 created the Army Medical Service Corps. The resulting conglomerate formation of personnel, ranging from ex-sergeants to scientists, is, in the opinion of many qualified scientists and engineers, totally incapable of serving the real need of national defense. Much less important than the unworkable set-up, is the discrimination in promotion fixed by this legislation.

The writer, with many others, opposed this legislation, insisting that there should be a non-medical professional corps as well as an administrative corps. In 1947, he received from the Medical Department the direct promise that remedial legislation would be introduced which would be "agreeable to you" ("you" being the writer). Later in 1947, I was told that it would be embarrassing to the Medical Department to ask revision of the same Congress that passed the original bill. Understanding that this might be so, I concurred in the delay.

In October, 1948, the deputy surgeon general wrote me that the Medical Department had no present intention of introducing remedial legislation, despite the previous promise to do so. "However," he added, "we are in agreement that the present limitation on (the number of) colonels is discriminatory and I believe at the moment it is more important to get this limitation removed than to initiate steps toward a professional corps."

The statement quoted demonstrates a lack of either sincerity or knowledge, or both. A checking of the list of Medical Service Corps officers, recently published, indicates that the present limit of authorized colonelcies will not be reached for probably 5 years or more. In other words, this statement is "baloney."

Whether it is the broken promise, which I accepted in good faith despite the warnings of many of my associates, or the insult to my intelligence by the quoted statement—I've had enough. The less I have to do with the Medical Department in the future, the better. Part of this determination stems from my firm conviction that, under the existing set-up, sound sanitary engineering in the Medical Department is impossible, and fooling around with it is a complete waste of time; part also stems from the fact that life is too short to work with folks you can't trust. So, I repeat, I've had enough.

W. A. Hardenbergh

County Engineers Know How To Use Road Equipment

In this issue we publish an article to which 247 county engineers contributed. We are proud of this article because we feel that it is effective testimony to the high technical abilities of our county engineers. Their problems are many. They have a manufacturing job to do—building and maintaining roads and bridges, primarily—but unlike the average manufacturing plant which is small in area, their operations may cover a thousand square miles of terrain, and often more. There is only one way to solve their far-flung problems, and that is by the use of modern, fast-moving, labor-saving equipment. How well they are doing it is indicated in the article. Yet these 247 replies are from only the first 367 returns; some 300 replies have since been received.

This effective use of modern equipment bears on the results of another survey we made a year ago. At that time we asked if the county engineer selected or recommended the public works equipment and materials used by the county. Of 819 replies, 633 were specific; 611 of these county engineers did select or recommend the equipment they used; 22 did not; 186 did not reply.

The returns of this later questionnaire indicate pretty clearly that the county engineers knew what equipment they wanted, why they wanted it, and how to use it. We congratulate them on the fine job they are doing.

The Big Job of Industrial Waste Treatment

The immensity of the job to be done in industrial waste treatment is perhaps not fully appreciated, but some authorities believe it will be the largest single item in the public works field during the next few years. More information is needed by engineers, and it should be in an easily utilizable form. To provide this, PUBIC WORKS plans to publish in 1949, a series of articles on industrial waste treatment, these to be authored by men of recognized authority in the field.

Special Congratulations Department

To Wallace and Tiernan Co., on their 35th anniversary—Nov. 13—for a fine job, well done; major contributors to the health of the world; sound engineers; realists; and leaders in research and development.

Here's the new addition to the Fairbanks-Morse Pump family . . . the Figure 5520A line of side suction centrifugal pumps. These open impeller, ball bearing pumps offer a new high in performance.

Designed for economical operation at heads up to 80 feet and capacities up to 2500 g.p.m., these new Fairbanks-Morse Pumps range in size from 2″ through 8″. They are available for either direct drive from motors or engines or from belt drives. Their unusual compactness assures important space-saving advantages with no sacrifice of efficiency or capacity.

WHEN IT COMES TO PUMPS...

Note these important design advantages:

- **Open type, single suction impeller, designed for high efficiency at moderate heads.**
- **Volute of close-grained cast iron with water passages so smooth that friction and back eddies are minimized.**
- **Deep stuffing box permits proper packing without undue tightening of the gland . . . simple, easy repacking.**
- **The same proved ball bearing frame construction for smooth operation and long life used in the other side suction pumps of the Fairbanks-Morse family. Bearing nearest impeller takes radial load only and is free to move endwise. Drive-end bearing takes both radial and thrust loads. Both are sealed to keep lubricant in . . . dirt and moisture out.**
- **One-piece, solid cast frame for long service . . . suitable for heavy duty belted or direct connected drives. Foot of frame forms a substantial base.**

For all the facts on this new line of pumps, see your Fairbanks-Morse distributor or branch house pump engineer. Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE

A name worth remembering

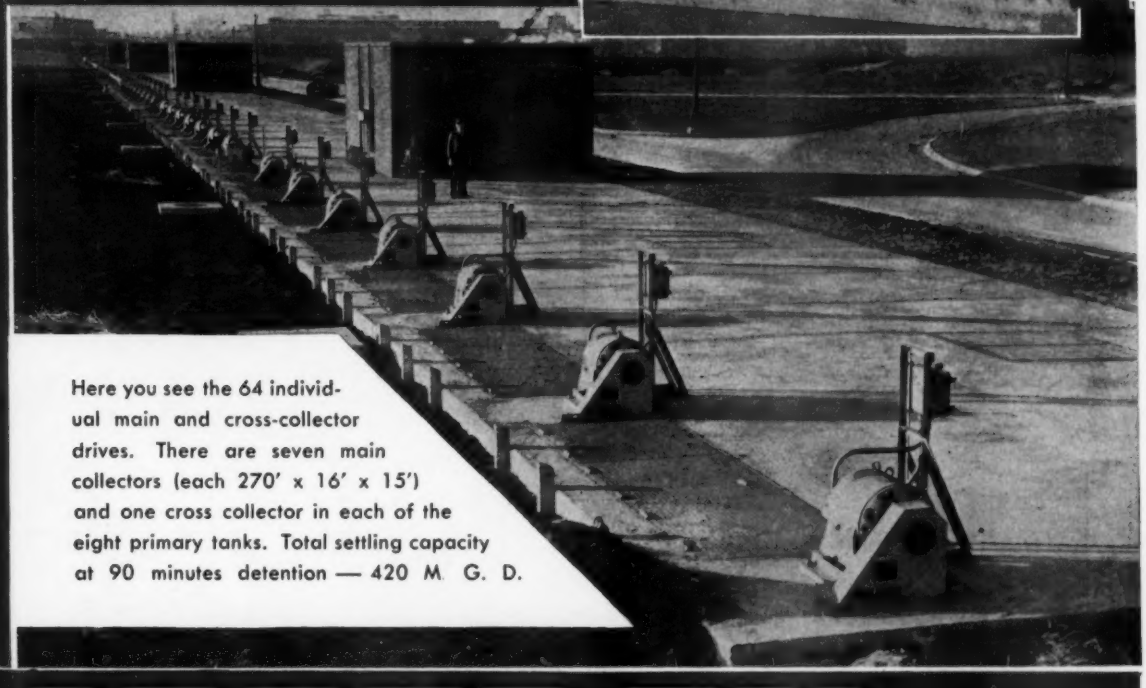
Diesel Locomotives • Diesel Engines • Stokers • Scales • Motors • Generators • Pumps • Railroad Motor Cars and Standpipes • Farm Equipment • Magnetos

one of the LARGEST . . . but Modern

Completely equipped by Jeffrey in 1939, the Detroit sewage treatment plant is still one of the most modern and up-to-date in the country today. Rectangular sedimentation tank design was adopted since scale model tests demonstrated their superior hydraulic efficiency. Jeffrey primary collectors, bar screens, belt conveyors, screenings grinders, scum removers and grit collectors are all doing a good job of it . . . as in other large Jeffrey-equipped plants. Our Sanitary Engineering Division is prepared to offer information on our line of proved equipment and plant design.

• • •

Right — view through one of the 270-foot main sludge collectors. There are fifty-six main collectors in the primary settling tanks. Space does not permit showing the six bar screens and the twelve grit collectors, designed for maximum flow of 900 M. G. D.



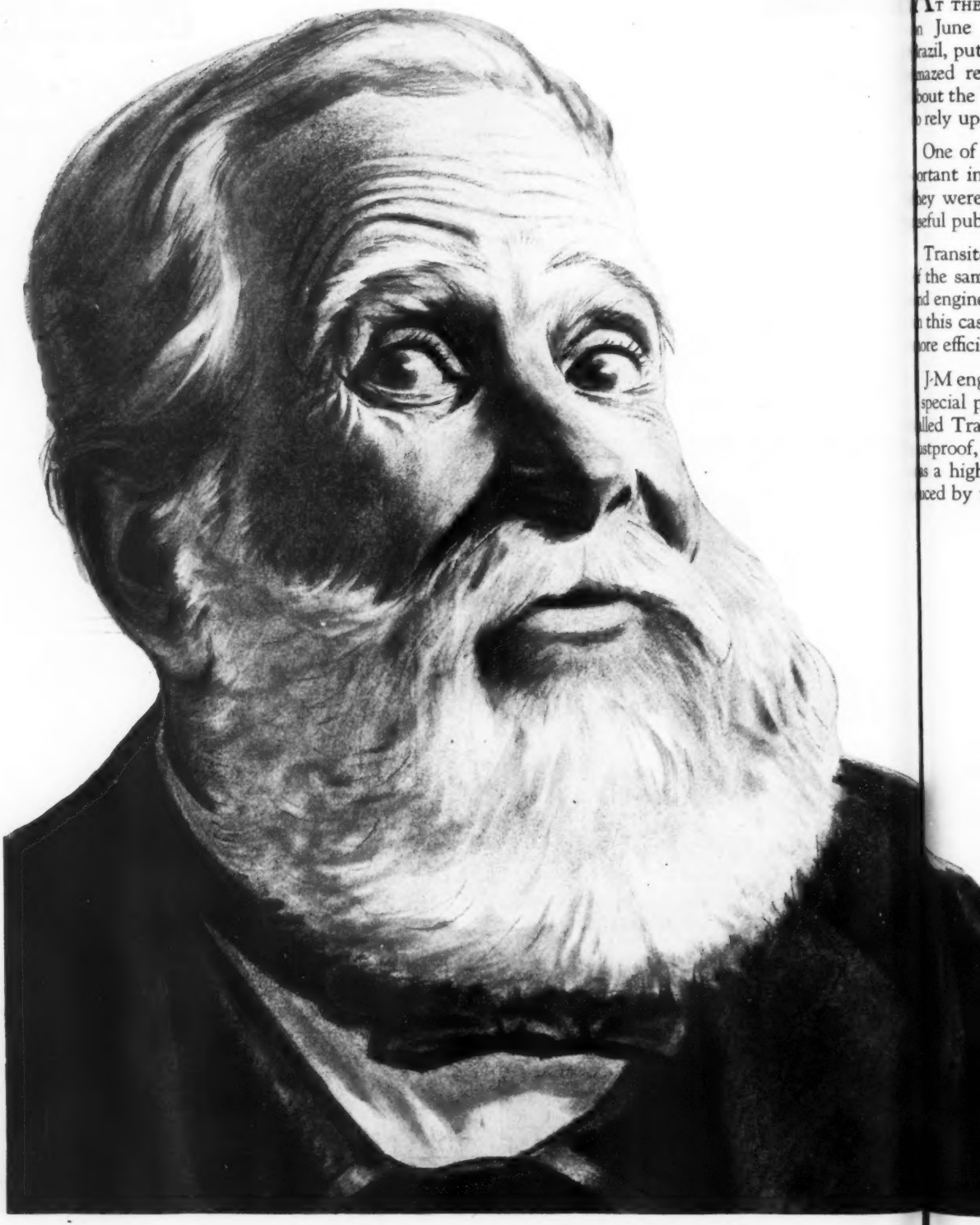
Here you see the 64 individual main and cross-collector drives. There are seven main collectors (each 270' x 16' x 15') and one cross collector in each of the eight primary tanks. Total settling capacity at 90 minutes detention — 420 M. G. D.

JEFFREY ESTABLISHED 1877

THE JEFFREY MANUFACTURING COMPANY, [illegible]

When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-80*

"IT TALKS," cried th



When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-80*

hEmperor of Brazil

AT THE PHILADELPHIA CENTENNIAL EXPOSITION, n June 25, 1876, Dom Pedro, Emperor of razil, put his ear to a strange looking gadget. His nazed reaction helped dispel public skepticism bout the "gadget"... and the world soon learned rely upon the *telephone* as a common necessity.

One of the reasons for the rapid success of imortant inventions such as the telephone is that ey were designed and engineered to perform a eful public service.

Transite Pressure Pipe is a more recent example the same sound principle. It too was designed d engineered to perform a useful public service. this case, the objective was to transport water ore efficiently and economically.

J-M engineers combined asbestos and cement by special process, produced a material which they lled Transite. Transite Pressure Pipe is strong, stproof, resists even the most corrosive soils... s a high-flow capacity which can never be reced by tuberculation.

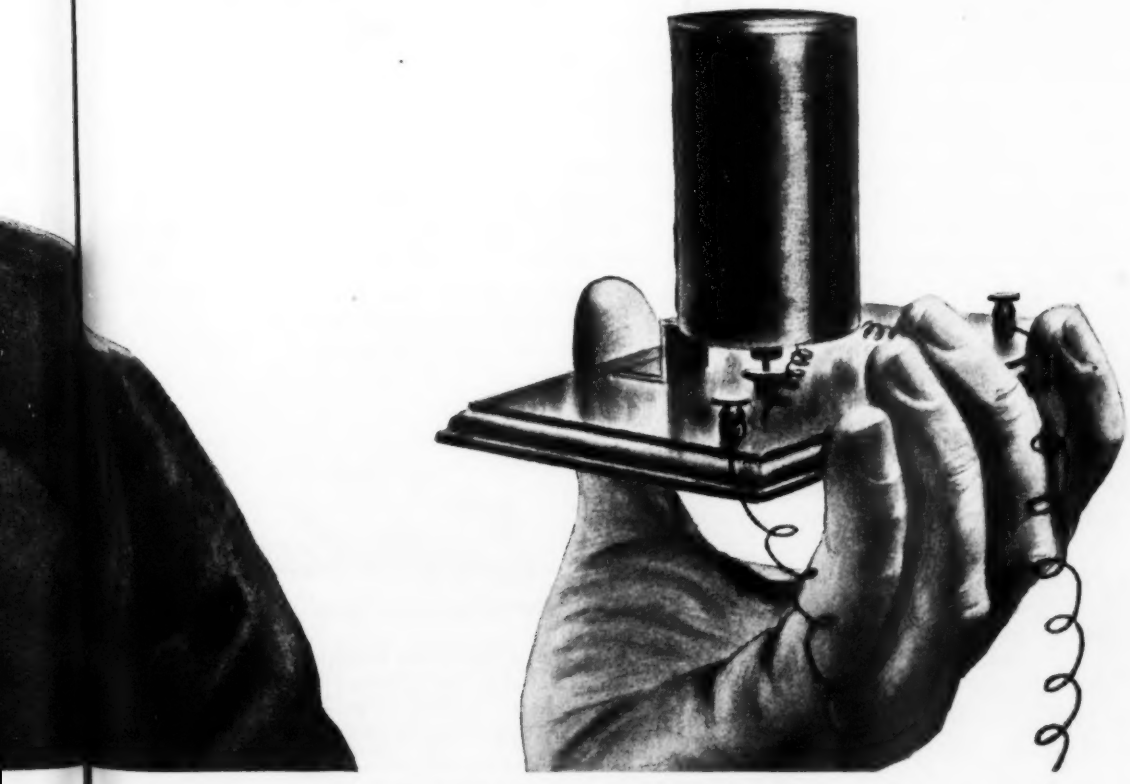
Then a coupling made of Transite was designed and named the Simplex Coupling. Simple and effective, it consists only of a Transite sleeve and two rubber rings tightly compressed into position between sleeve and pipe. This construction guards against leakage and also provides flexibility at each joint. The flexibility helps to cushion the entire line against shock and soil stresses, permits a deflection up to 5 degrees at each joint.

In short, the same kind of engineering foresight and planning that produced the telephone, the steamboat . . . and similar developments which have contributed to industrial progress . . . has been applied to the transportation of water.

Transite Pressure Pipe is now serving the public by delivering clean, healthful water, in abundant quantities, in thousands of communities throughout the nation.

For all the facts about Transite Pressure Pipe, write Johns-Manville, Box 290, New York 16, New York. Ask for Brochure TR-11A.

JOHNS-MANVILLE JM PRODUCTS

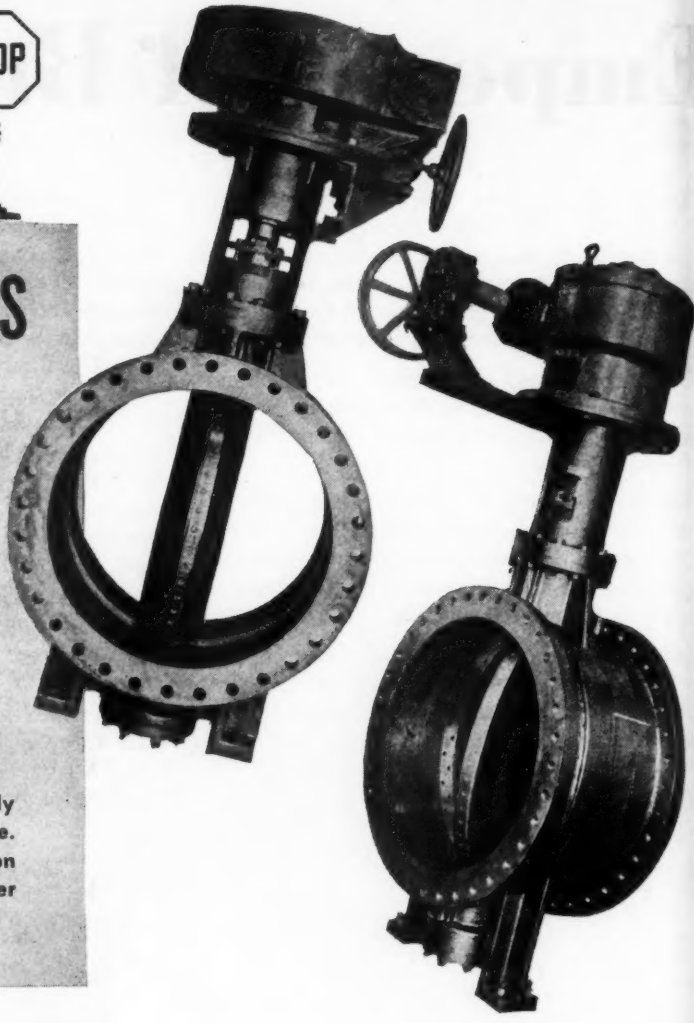


TRAFFIC CONTROLS

for San Diego water supply

fitted with *Everdur* AND BRONZE

Key parts of these 36" and 42" butterfly valves are made of Everdur and Bronze. Valves made by Coldwell-Wilcox Division of Krajewski-Pesant. Hydraulic Engineer for the city of San Diego: Fred D. Pyle.



DOWN from the Alvarado Regulating Reservoir rushes the water supply for San Diego, California, under 100 lb. pressure. Among the controls for this man-made underground river are these two butterfly valves, 36" and 42" I.D., which together weigh 16,000 lbs.

Many vital parts of these valves are made of Everdur* Copper-Silicon Alloys to insure long, dependable service. The shafts (respectively 5" and 5½" diam.) and seating rings in the body and in the disc are of Everdur. The ⅜" seating rings are fastened with Everdur screws. The stuffing box followers are of bronze with Everdur bolts throughout.

Why was Everdur chosen for this critical service? Because these famous alloys have proved thoroughly reliable in hundreds of water and sewage works applications. As a group, Everdur Alloys combine excellent corrosion resistance with high tensile strength, high fatigue limit, and good workability by all methods, including welding.

It pays to be familiar with the many ways in which you can take advantage of Everdur Alloys. For detailed information, write for Publications E-11 and E-5. 48184

*Reg. U. S. Pat. Off.

ANACONDA
from mine to consumer

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

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New Toronto, Ont.

Letters

INCINERATION COST DATA

We note in the September issue of PUBLIC WORKS an article "Refuse Disposal in Maryland" which contains the following statement: "A total of 23,634 tons of garbage and rubbish, or about 80 tons per day, was consumed at the 150-ton incinerator at Lyttonsville in the Washington Suburban Sanitary District. The total cost of operation was $3.48 per ton."

Although we do not have details of cost of operation of the incinerator plant at Lyttonsville, which has two Nichols Monohearth mechanically stoked incinerator units, we do not see how the above figure could possibly be correct, even including all fixed charges.

For example, this plant operates two shifts a day. During the day shift there are five men, and during the afternoon shift four men. We do not know the actual rate of pay, but this, with normal supervision charges, would probably represent a total labor cost of about $90 per day. The plant was reported to have been burning about 80 tons per day, which would mean that the total labor cost would be in the neighborhood of $1.10 per ton. No extra fuel is used, and the cost of power and maintenance is quite low so that the total direct operating cost including maintenance would probably not exceed **$1.30 or $1.40 per ton, as a guess.**

The construction cost of this plant was in the neighborhood of $250,000, and assuming that the bonds are written off over a 20-year period, the amortization charge at 5% would average $12,500 per year. Assuming 3% interest, the interest on the average unamortized value of the plant would average about $3,750 per year, making the total fixed charges $16,200 per year. It was reported that 23,634 tons of garbage and rubbish were burned, so that the fixed cost would therefore amount to 68½¢ per ton.

It would therefore appear that the correct figure for "cost of operation," which is the statement used in the article, should be in the neighborhood of $1.30 per ton, and the fixed charges of interest and amortization should be in the neighborhood of 70¢ per ton, making the total, including fixed charges, about $2 per ton.

R. W. ROWEN,
Vice President,
Nichols Engineering & Research Corp.

Upon receipt of the letter from Mr. Rowen, we wrote to Harry Hall, Chief Engineer of the Washington Suburban Sanitary District, which supervises the operation of this plant, and obtained the following data:

"The operating cost figure for the Lyttonsville incinerator of $3.48 per

ton was not prepared by this office and I am unable to tell you how it was arrived at. The figure actually should be $2.24 per ton broken down as follows:

Office expense	$0.03
Superintendence	0.08
Disposal	1.46
Engineering & Adminis.	0.11
	1.68
Bond charges	0.56
	$2.24 per ton."

HARRY B. SHAW,
Deputy Chief Engineer.

A breakdown of disposal costs has been received also and will be published later.

The Editors.

HISTORICAL NOTE

The "Decatur" mentioned in the article on Sewage Lagoons is the city dear to crapshooters' parlance, as this is the place called upon when making ol' No. 8—"An eighter from Decatur."

D. F. SMALLHORST,
Austin, Texas

THE ARMY RESERVE

I am a student in the sanitary engineering option and expect to graduate in August, 1949, at which time I shall hold a reserve commission in the Corps of Engineers. . . . I have served two years with infantry and training units and am aware of the importance of having well-schooled personnel in positions which require specialized knowledge. Prof. Bloodgood has suggested that I write you so that I may find the best field for sanitary engineering work in the Army.

JOHN A. GILLESPIE,
West Lafayette, Ind.

Under existing conditions, the Medical Service Corps offers an extremely weak organizational set-up, limited promotion, small opportunity for constructive work and practically non-existent training facilities—that is, unless you want to listen to lectures on "Amputation Techniques," etc. There are no summer training camps for engineers; if you go to a medical training camp you will spend your time on minor medical administrative jobs. You will get very little consideration and even less opportunity. I strongly recommend the commission in the Engineer Reserve. There are two precautions to follow: (1) Be sure that your primary occupation is given as Sanitary Engineer and your secondary occupation is Civil Engineer. Insist that your occupational specialty number (MOS) is 7960. This will permit you to be picked up at any time as a sanitary engineer through the machine records.

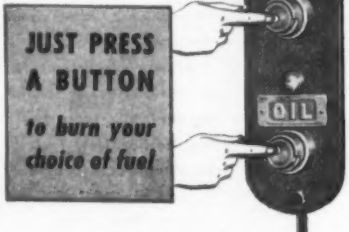
The Editors.

When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-80*

There'll be Bright Lights in the Old Town Tonight

PUSH-BUTTON DUAL FUEL

A Superior Feature



Superior is the first and only Diesel with push-button control of fuel selection that permits you to switch from oil to gas; or gas to oil instantly —with the flick of a finger.

● Yes, tonight and every night an Iowa town will have bright lights that signal a dependable source of electrical power. The power is supplied by a model 80-GX-8 Superior Diesel that develops 1500 hp. at 360 rpm.

In addition to supplying the town with electrical power, this Superior produces a surplus which is sold to surrounding farms.

Many communities and industrial plants depend on just one Superior Engine for their entire power supply. This faithful performance is due to the following features offered by these tough engines: Conservative Ratings • Efficient Pressure Lubrication • Clean Combustion • Precision Bearings • Heavy Rigid Crankshafts • Strong Bases and Cylinder Blocks • Proved Roller Chain Camshaft Drives • Oil Cooled Pistons. We will be glad to send you a fully illustrated booklet that tells how these features can help you.

THE NATIONAL NSCO SUPPLY COMPANY

Superior DIESEL

60th Anniversary

When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-80*

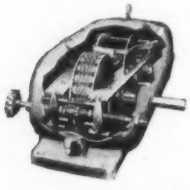
LINK-BELT INSTALLATIONS ARE BUILT WITH *LINK-BELT MANUFACTURED COMPONENTS*

LINK-BELT *MEANS EVERYTHING* IN POWER TRANSMISSION AND CONVEYING

The unfailing operation of a sewage or industrial liquid treatment plant or a water purification plant depends on the faithful performance of its power transmission, driving, conveying and other units. To insure a smooth flow of power to the individual working units of an installation, Link-Belt offers a wide variety of power drives specially adapted to sewage or water works use.

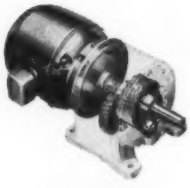
In power transmission devices as in materials handling equipment, Link-Belt means a high standard of quality...a comprehensive line...nationwide service...responsibility for performance. Link-Belt chain drives, bearings, sprockets, speed reducers and speed changers use power *fully* by giving *positive, non-slip* transmission—dependable operation day after day under difficult conditions. In L-B installations there is no divided responsibility.

Link-Belt engineers are constantly cooperating with consulting, municipal and sanitary engineers to achieve positive results and highest efficiency.



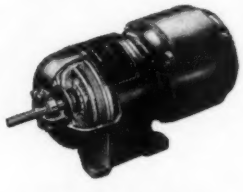
P.I.V. GEAR SPEED CHANGERS

Permits infinite variation of speed while machine is running; holds set speed, without slip or creep. ½ to 25 h.p. vertical or horizontal units.



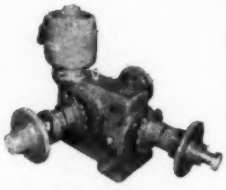
GEARMOTORS

Safe, compact, efficient. Output speeds from 280 to 6 R.P.M. in standard line of double and triple reduction units.



ELECTROFLUID DRIVES

Combined standard induction motor with hydraulic coupling, for smooth starting—protecting against shock load. Avoids "overmotoring."



WORM GEAR SPEED REDUCERS

Suited to high ratio reductions, with vertical or horizontal output shafts. Quiet, smooth operation. Compact.

ROLLER CHAINS

For positive power transmission at high or low speeds, coordinating rotation of numerous shafts. For short or long centers.

PROMAL CHAINS

Promal possesses all qualities desirable in a cast sprocket chain: toughness, strength, high yield point, high resistance to abrasive wear.

CONVEYOR BELT IDLERS

Bearings are sealed to keep grease in, dirt out. Sturdy, well-balanced rolls. Tough malleable iron brackets.

SCREW CONVEYORS

Sectional flight and Helicoid types. One moving part. Compact. No idle portion. Operates horizontally, vertically or inclined at any angle.

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More than two miles of Vitrified Clay Pipe, ranging from 18 inches to 36 inches in diameter were used for the Raymond Avenue Outfall Sewer, City of Pasadena, California. It reaches from Garfield Avenue and Arroyo Seco Parkway to the city limits of South Pasadena. City Engineer: John H. Allin. Chief Inspector: Charles Schultz. Contractors: Bebek & Brkich, Los Angeles.

Contractor Nick Bebek of Los Angeles says: "There's nothing like Clay Pipe for sewers. It's the very best. Clay Pipe lasts forever. Why, on one job in Los Angeles I dug up Vitrified Clay Pipe that had been in place for 72 years. It was just like new."

MUNICIPAL officials of Pasadena, California *insisted* on Vitrified Clay Pipe for their new Raymond Avenue Outfall Sewer, because they knew that Clay Pipe is the *only* pipe which resists the deteriorating action of sewage.

In addition to being non-corrosive, this new outfall line had to carry extra-heavy earth and traffic loads. Trenching at one place crossed a ravine of the Arroyo Seco, which was formerly used as a city dump. Through several layers of ancient refuse, 70 feet of cradling was necessary. At another spot the trenching skirted the base of a rocky hill. Fifty feet of trench had to be finished with a pneumatic drill through the rock formation. At still another spot, trenching passed under the six-lane Arroyo Seco Speedway.

The Arroyo Seco six-lane speedway. A 150-foot vitrified clay outfall sewer passes beneath this paving.

Engineers specified Extra-Strength Clay Pipe where necessary to withstand severe loading and Standard Strength Clay Pipe for the rest of the line.

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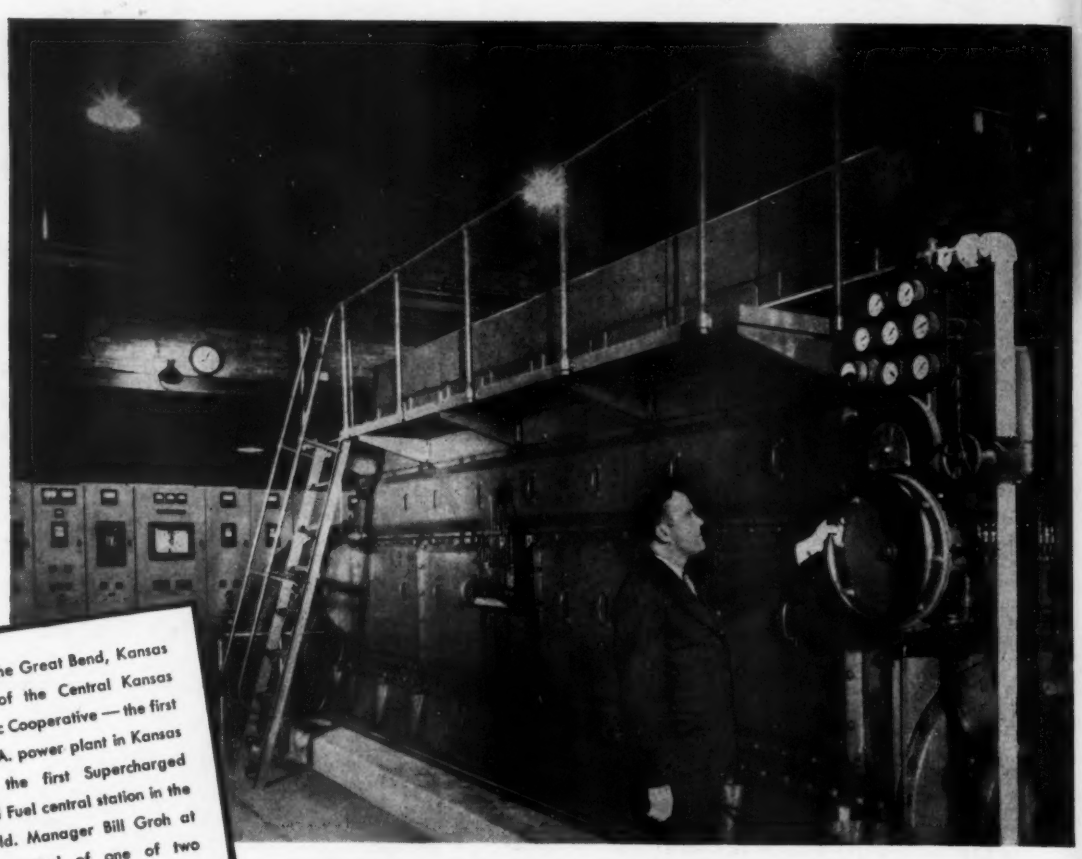
Vitrified CLAY PIPE

CLAY PIPE NEVER WEARS OUT!

C-248-4

When you need special information—consult the **READERS' SERVICE DEPT.** *on pages 77-80*



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"TOTAL FUEL AND LUBRICANT COST PER KWH—$0.0015+!"

Kansas R. E. A. Station Reports Steady Savings With Worthington Supercharged Dual Fuel Diesels

One way to get the real low-down on economical generation of electric power is from a progressive R. E. A. plant. Here, in part, is what the Central Kansas Electric Cooperative Association has to say about its Worthington Dual Fuel Diesel equipment:

"Our engines have run approximately 3050 and 4100 hours, respectively, under loads varying from 300 to 1160 KW. Operation has been satisfactory at all loads.

"One remarkable point is the low lubricating oil consumption . . . Also, we have had very little maintenance work.

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With Worthington Dual Fuel Diesels you get outstanding thermal efficiency on the cheapest fuel available — oil, gas or oil-and-gas in any ratio — while Worthington's long leadership in developing Diesel design and performance means additional power for every operating-dollar you spend. For further proof that *there's more worth in Worthington*, contact *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.*

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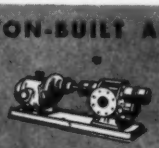
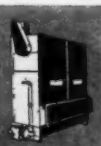


Oil Transfer Pumps

Cooling Water Circulating Pumps



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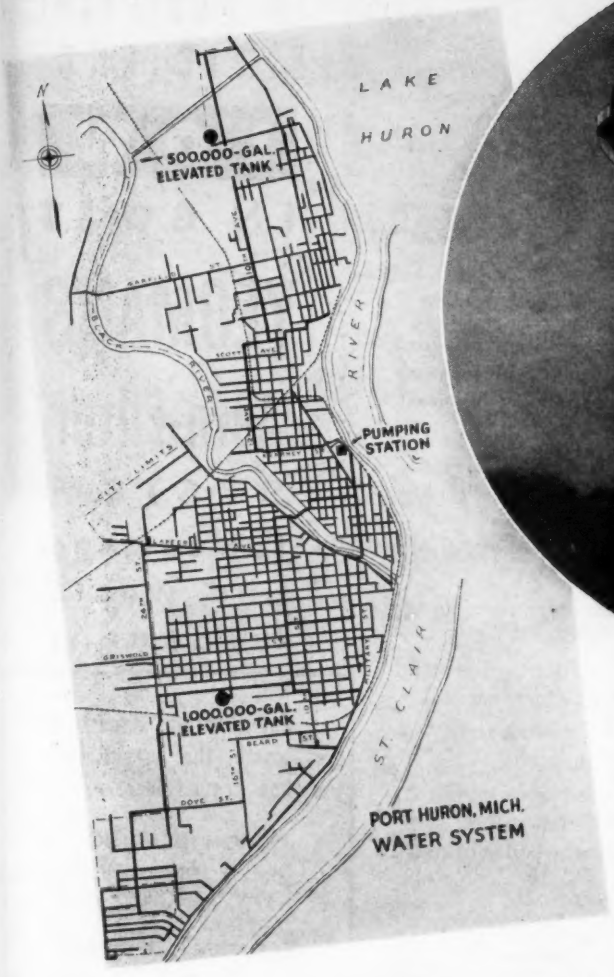
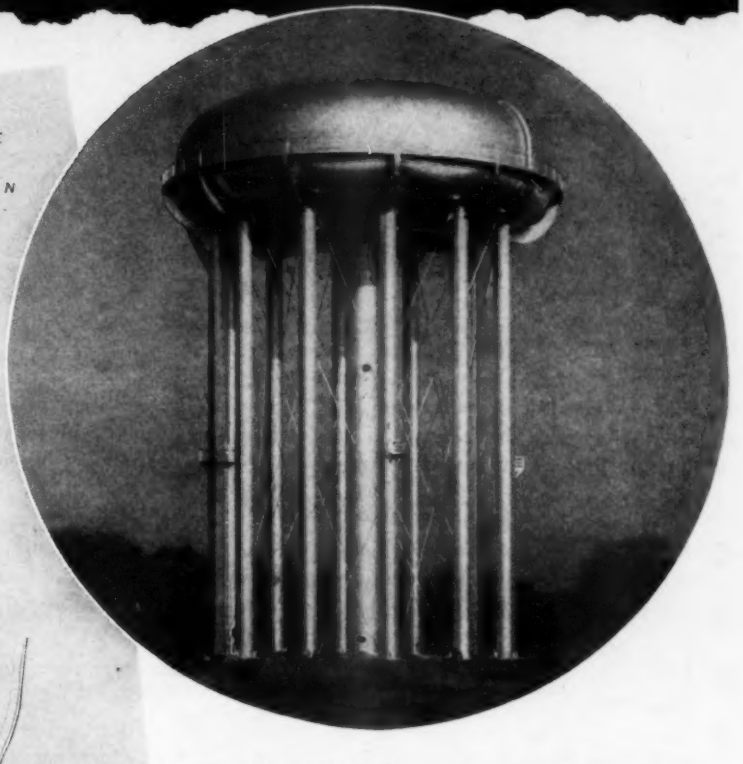
- maintains uniform pressure in mains
- helps to meet peak loads

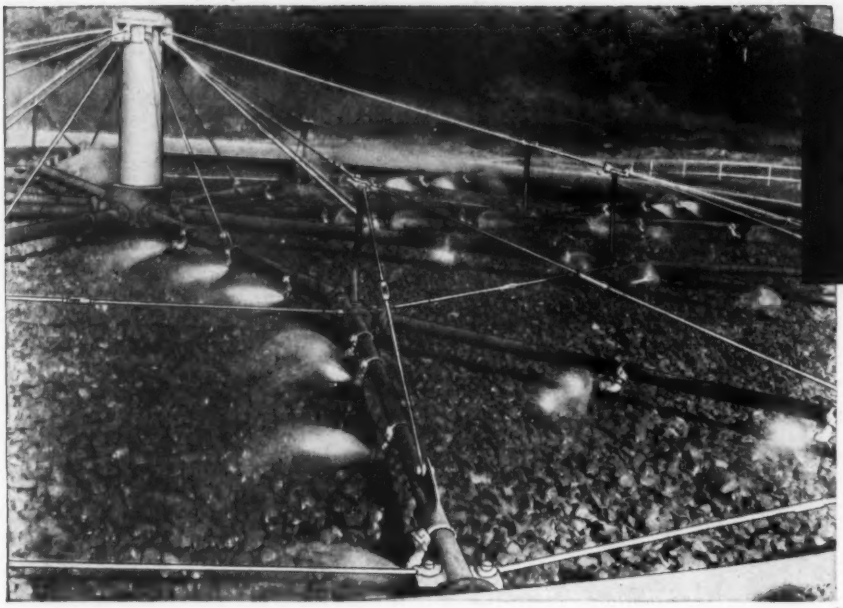


A map of Port Huron, showing where the Horton tanks are located to provide "distributed storage" at the out-lying points of the water distribution system.



The 1,000,000-gal. Horton elevated tank shown above, and another Horton tank of 500,000 gals. capacity, were erected at Port Huron, Michigan, where the water they hold in elevated storage is the source of gravity pressure in the water system. The engineer who installed the tanks expects the city to benefit in two principal ways. First, the tanks will hold a reserve of water which can be pumped into them during slack pumping periods, and at times when electric power costs are lowest. The reserve water will help the pumps to meet afternoon peak loads and maintain service during short-time pumping failures. Second, the tanks are located at opposite ends of the city in order to add gravity water pressure in those parts of the distribution system most distant from the pumping station.

When you need special information—consult the READERS' SERVICE DEPT. *on pages 77-80*



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6. Uninterrupted and almost complete momentary bed coverage minimizes troubles from odors, freezing, ponding and filter flies.
7. All returns are made direct to the filter—therefore an oversize primary tank to accommodate recirculation is unnecessary.

The "Aero-Filter" can be fitted to any requirements, from small units up to large treatment works. Accurate cost estimates and complete engineering data are readily obtainable — simply write us.

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Especially important in treating exceedingly strong waste.

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PUBLIC WORKS MAGAZINE . . . December, 1948

VOL. 79. NO. 12

PROBLEMS IN BRIDGE BUILDING

C. ARTHUR ELLIOTT
County Engineer, Greene Co., Iowa

WHEN a heavily loaded stock truck, in 1935, collapsed one of Greene County's old high truss river bridge spans, the bridge department of the Iowa State Highway Commission was asked to make a stress analysis of the remaining structures. As a result of this investigation every river bridge this county maintained was embargoed for a 6-ton load limit. With rural and urban gross truck loads of 10, 15 and more tons and our own road patrols and snow plows weighing up to 20 tons, the county suddenly realized that its river bridges constituted a serious and dangerously weak link in their otherwise advanced secondary road system.

Consequently, twelve years ago Greene County started a program to replace the ten antiquated, narrow and severely overstressed bridges spanning the Raccoon River which crosses the county diagonally from northwest to southeast. In 1936, these ten bridges consisted of light multiple and single high truss steel and iron spans, malleable iron bow-string spans and wood trestle approaches of various lengths. These bridges varied in total length from 250 to 400 feet with mean roadway widths of 14 and 16 feet. Since the average age of these structures was over fifty years, obviously they were built for horses instead of our present day automobile and truck traffic.

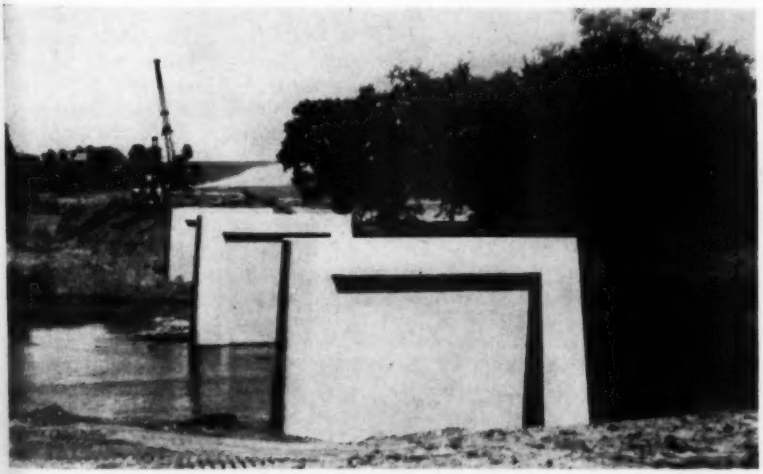
Without exception each bridge was approached with a sharp curve at either end and high speed, heavy loads added a severe side thrust to the already overloaded light members. This severe angular impact was a definite factor in collapsing the structure mentioned in the first paragraph. Bridge floors consisted of 3-inch wood plank which required replacing every three to five years. No doubt Greene County has duplicated the original cost of these bridges many times down through the years in new floor plank.

¾-yd. dragline ready to drive steel piling

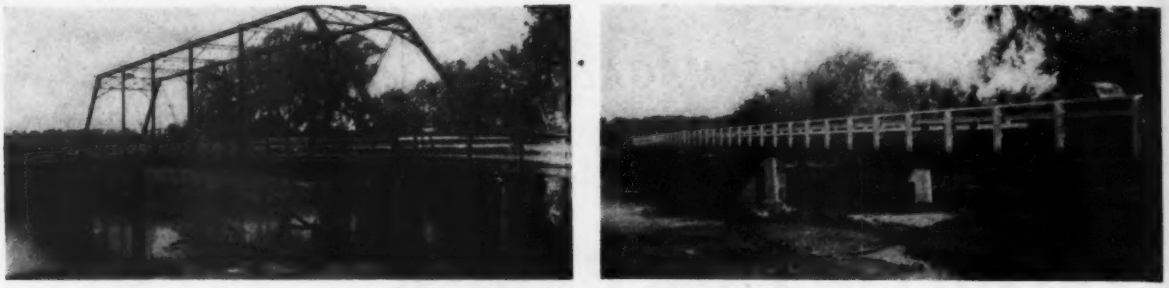
In replacing the wrecked bridge, a contract was let for a 162′ x 20′ steel high truss span with four 42′ I-Beam approach spans with concrete piers, abutments and floor. However, after building this one new high truss span, the county decided that truss spans constituted an overhead clearance hazard to traffic and also required considerable painting and cleaning to prevent rust. As a result of this decision we abandoned the truss design and adopted the more modern and practical continuous I-Beam span. The next two bridges built by contract in 1938 and 1939 were each 374′ x 22′ Continuous I-Beams. These two bridges replaced structures over sixty years old.

Bridge No. 4, which was to replace a bow-string span of ancient vintage, was advertised for bids early in 1942. Knowing the scarcity of steel and doubtful delivery of materials, alternate bids were received on a 300′ x 20′ continuous I-Beam and a 297′ x 20′ continuous concrete girder bridge. The continuous concrete girder bid was low and the bridge was constructed in the summer of 1942. Incidentally, this 297′ continuous concrete girder is the longest bridge of its kind in Iowa.

The war of course forced a suspension of our bridge program until 1947 when a contract was let to C. Ray Yegge & Sons of Boone, Iowa, for a 333.5′ x 22′ continuous I-Beam span. Three weeks after completion of this structure the Raccoon River on June 23, 1947, reached a flood stage nearly five feet above any pre-



Looking east across completed piers



The old and the new—old truss bridge is replaced with new continuous I-beam.

viously known level. The old bridge just above this new one was completely wrecked by the flood and portions of the wood trestle carried down against the new piers. Even though the high water washed away a part of the earth approach fill to the new bridge, repairs were made and traffic continued over the new structure less than three days later.

This same extreme high water advanced the building of bridge No. 6. Some sixty feet of wood trestle approach to what is known as the Vance Bridge was carried away and the two steel truss spans were moved down stream several inches on their bearing plates. Since this bridge is located on our Federal Aid Secondary system the Bureau of Public Roads included the construction of a new bridge at this site in its emergency relief secondary program. With Farm-to-Market funds matching half of the cost and the other half borne by the federal allocation, Greene County received a "free" bridge. A contract was awarded to F. O. Montgomery Company of Humboldt, Iowa, for approximately $89,000 in April of this year for the construction of a 333.5′ x 22′ continuous I-Beam Bridge. Incidentally, $89,000 for 333.5′ of bridge makes an average cost of $267 per foot of bridge. In 1938 the last continuous I-Beam bridge which was 374′ long was built for an approximate cost of $33,000 or an average price of $88 per foot. The increase in bridge prices of 303% for those two bridges over that period of years is indicative of the trend of the times in bridge construction costs.

The bridge which Montgomery is now building, and of which he has the sub-structure completed, has presented some difficult pile driving problems. With the other five bridges and two that the state has built on primary roads across the Raccoon River no difficulty was encountered in getting sufficient penetration and the required 18-ton bearing with the specified 20′ and 25′ wood foundation piles. However, this bridge has been considerably different. Test borings at either end of the bridge site showed some 35 feet of sandy loam, fine sand and gravel with 77% of the coarser material passing a No. 8 screen. Even though the test holes did not show any appreciable amount of the usual clay encountered along the Raccoon River, it was assumed that the standard 25′ wood piling would give the desired penetration and bearing. The footing for the first pier indicated the fallacy of such an assumption. The footing plan required 25 wood piles driven to an average bearing of 18 tons computed by the Engineering News-Record formula of

$$P = \frac{2WH}{S+1}.$$

Of these 25 wood piling only 11 were driven to the required penetration and their average bearing was 28 tons. Without a doubt the bearing end of these piles would show considerable brooming. The piles drove hard from the first blow and with a 2250# hammer dropping 17 feet the average penetration per blow was from ¼″ to refusal. Wood piles will not stand such punishment without shattering so after breaking one off some 8′ above cutoff elevation an attempt was made to jet the piling into place. A 2″ pump feeding a 1-inch nozzle was able to jet down about 8′. At this point a layer of coarser material was encountered and the lighter material above this gravel was washed away in such quantities that the sheet piling in the cofferdam started moving. Since jetting was impossible it was decided after a conference with the Bureau of Public Roads to try H-Section steel piles.

A supply of 10″—42# H-Section piles was located at Pittsburgh-Des Moines Steel Company and these were driven in the first footing to complete the foundation. These steel piles drove equally as tough as the wood but were able to take it better although some of the steel piles deformed so badly before cutoff elevation was reached that further penetration was impossible. The average bearing of these 24 steel piles was 35 tons as computed by the new Iowa Highway Commission formula of

$$P = \frac{3WH}{S+0.35} \times \frac{W}{W+M},$$

where W is equal to the weight of the hammer, H is the height of drop and M is the weight of the pile plus the driving block.

Piers No. 3 and No. 2 offered the same driving difficulties and it was necessary to use steel piling in both of the footings. However, since the required bearing was being obtained almost immediately it was decided as economical and practical to reduce the number and length of the steel H piles. Consequently, only 20 piles 20′ long were driven in the foundations of these last two piers. The average bearing obtained in these footings was 35 tons per pile.

The two abutments of this bridge were placed on 15′ fills of compacted fine sand, with traces of fine loam, hauled from a channel change in the river adjacent to the bridge site. The plans specified that 35′ creosote wood piling be driven to support the concrete cap abutment. Potential flood stage scouring of these sandy fills made maximum penetration equally as important as bearing value. Of the first 13 wood piles driven, 6 were broken off at various heights above cutoff elevation. The sand fill was just too dense for wood piles and it was necessary to order steel.

Substituting 35′ lengths of the H Section 10″—42# steel we were able to get nearly all of them down to maximum penetration. As far as the writer knows this is the first time in this county that steel piles were found necessary for bridge foundations.

With another 300′ x 22′ continuous I-Beam span scheduled for next year, Greene County will soon have her river bridges completed. If the old steel and wood bridges lasted for 50 to 70 years, these steel and concrete spans should take care of our river bridge problem for at least the next 100 years.

STUDIES OF SEWAGE LAGOONS

JACK MYERS

With comments by D. F. Smallhorst. Both are with the Bureau of Sanitary Engineering Texas State Department of Health

THE use of sewage lagoons or oxidation ponds has been described by Giesecke and Zeller (1), by O'Connell and Gray, with discussions by C. G. Gillespie and W. T. Knowlton (2), and by Caldwell (3). It has been established that raw or pretreated sewage may be treated adequately by retention for a period of several weeks in shallow artificial basins. Data from lagoons in Texas (1) and Southern California (2) indicate that reliable year-around operation may be obtained with a loading of about 40 pounds of BOD per acre per day. It appears that algae are effective biological agents by virtue of their oxygen production in photosynthesis. The data of Caldwell support this, and show that (1) the DO may decrease to zero at night and rise to 300% of air saturation during the day; and (2) in a series of lagoons, the later units may attain a higher DO during the day with a shorter period of zero DO at night.

An inspection of 15 sewage lagoons and a field-laboratory study of the Decatur and Killeen lagoons was made in June and July, 1948. This article is based on that study, supplemented by data of previous studies by A. J. Espinosa, J. L. Robinson, Jack Myers and Sam M. King, all of the Texas Bureau of Sanitary Engineering.

Results of the Field Study

As indicated by Table I, there is great diversity in almost every feature of these lagoons, including area and type of sewage treated. There is no consistency in the type of algae found, nor any apparent correlation between the predominant local species and any other local condition. Observations of local operators indicate that the predominant species may change from time to time in any lagoon. The lack of any serious odor nuisance is, however, generally true.

The field-laboratory study of lagoons at Decatur and Killeen included: (1) routine analyses of 24-hour composite samples; and (2) temperature, DO and pH determinations at different depths over a 24-hour period. Both Killeen and Decatur are considered to be secondary treatment installations; hence relatively weak sewage (BOD 91 and 66) is involved. While data are not at all uniform, the trends are quite consistent. The results of the Killeen study are presented since they describe (1) a more extensive system of lagoons; (2) the operation of deeper lagoons; and (3) a higher BOD loading.

The Killeen treatment plant, which handles the sewage from the City of Killeen and Camp Hood, was designed as a contact aeration plant, with primary settling, aeration and secondary settling. In 1942, due to severe overloading, the lagoons were built. There are 8 lagoons, operated in series, but the first four are considered primarily here because the effluent from No. 4 appears to have the lowest BOD. The first lagoon receives the effluent from the primary settling tank, without other treatment.

Data on the 24-hour composite samples, summarized in Table II, indicate a rather complete removal of unstable organic matter in the first four lagoons. Very light algal growth in No. 4 coincides with minimum BOD. Subsequent increase in Nos. 5, 6 and 8 appear related to heavier algal growth. The total and volatile suspended solids also appear related to algal growth.

Data were obtained on samples collected from the outlet boxes of lagoons 1 and 5 at depth of 6, 12, 18, 24 or 36 ins. Lagoon 1 had a high BOD loading and a population of green flagellates which varied from time to time. Lagoon 5 had a low BOD loading and a remarkably dense and constant population of colonial blue-green algae. DO and pH in the surface layers show the same diurnal variation reported by Caldwell.

Lagoon Characteristics

In the daytime, the oxygen concentration decreases rapidly with depth. This may be correlated roughly with the light intensity as measured by a barrier-type photocell, though there are variations in different lagoons. Another characteristic is the tendency for DO, pH and temperature at all depths (above 3 ft.) to equalize at night. During the day, the temperature in the surface layer rose several degrees (C) above the air temperature and that of the lower

TABLE I—TEXAS SEWAGE LAGOON DATA

City	Flow Mgd	No. of Lagoons	Total Acres	Treatment*	Final Disposal	Algae**
Abilene	3.25	8	50	None	Irrigation	a, b
Alamo	0.03	1	2	Filt.	"	c, e
Boerne	..	3	1	Filt.	"	a, d, e
Coleman	..	2	4	Sed.	"	a, b
Comanche	0.27	2	4	Sed.	"	b
Decatur	0.10	3	3	Filt.	Stream	a, d
Edenburg	0.80	1	26	Complete	Ditch	c
Killeen	0.75	8	40	Sed.	Stream	c, d
Kingsville	..	1	6	None	Stream	f
Mathis	..	1	4	Sed.	Stream	e
Premont	..	1	2	None	Irrigation	d
San Antonio	45.0	1	350	Part	Stream	f
Temple	2.0	1	12	Part	Stream	g

Mission, 2/3 acre, raw cannery waste: Sherman, 13 lagoons in 2 series, waste from a shortening plant.

*Treatment: Filt.--Settling and trickling filters; Sed.—Settling alone.

**Key to algae: a—unicellular greens; b—colonial greens; c—large spiral blue-greens; d—green flagellates; e—colonial blue-greens; f—rod-shaped blue greens; g—small unicellular greens as scenedesmus.

layers. At night the air temperature typically dropped 8 to 10 degrees. At night the temperature differences may bring about thermal currents which cause mechanical mixing between the surface and lower layers.

A third feature of lagoon behavior is with respect to the rate of oxygen removal at night. In lagoon #1 the high BOD loading imposes an oxygen demand so great that the DO is reduced to zero for a considerable period at night. Furthermore, the rapid rate of decrease in DO is evidence of a rapid oxidative activity by the microbial flora of the lagoon. It has been calculated that on the night of July 16 the oxygen consumption at the effluent end of lagoon #1 attained a rate of 16 pounds per acre per hour.

Comparison of the daily cycles in lagoon #1 and #5 establishes that: (1) the algae may produce during the daytime much more oxygen than they themselves will re-use during the night, and (2) the source of oxygen for the aerobic microbial decomposition of organic matter comes principally from algal activity (photosynthesis) during the day.

Important Considerations of Algal Physiology

Algae appear to be effective biological agents in sewage lagoons by virtue of oxygen production in photosynthesis. Present knowledge of their physiology is fragmentary and derived from laboratory studies limited to a very few forms, principally the green algae, *Chlorella* and *Scendesmus*. The following generalizations, although admittedly tentative, appear justified in effort to understand the role of the algae.

1. Photosynthesis is a process in which oxygen is excreted from the cells but almost all the organic material is retained and converted into cellular materials. This is important, for if the algae were to excrete soluble organic materials, their net effect would be to increase rather than decrease the amount of unstable organic matter.

2. The rate of oxygen production by an algal cell in the light may be 10 to 20 times the rate of its respiratory oxygen uptake in the dark.

3. Photosynthesis in an algal cell reaches a maximum rate at a light intensity in the range of 50 to 500 foot-candles. (Full sunlight is about 10,000 f.c.) Oxygen production in photosynthesis decreases with depth. The use of shallow lagoons appears more efficient from the standpoint of illumination but may give rise to problems in weed control and higher temperatures during the day.

4. Photosynthesis is relatively independent of temperature but the overall metabolism and growth of the algae is markedly affected by temperature.

5. Carbon dioxide is taken up by the algae principally as free carbon dioxide—CO_2 or H_2CO_3. Little, if any, is taken up as bicarbonate or carbonate. This accounts for the daily cycle of pH and the general rise in pH throughout a series of lagoons. Rate of photosynthesis in the algae is proportional to the carbon dioxide concentration up to about 1×10^{-5} moles per liter; above this, rate is independent of concentration. The data indicate that at pH values up to about 9 adequate carbon dioxide concentrations are available for photosynthesis.

6. Since illuminated algae excrete no other gas than oxygen, they may produce oxygen concentrations up to 39.2 ppm at 25° C.

Biological Mechanisms

As a result of photosynthetic activity during the day, it appears the algae bring about a rapid production of oxygen and uptake of carbon dioxide. The high oxygen concentration during the day allows an aerobic microbial flora to bring about rapid oxidation of unstable organic matter, with production of carbon dioxide. Some organic materials of sewage and some bacterial products, other than carbon dioxide, may also be utilized by the algae directly. At night the algae take up oxygen for their respiratory processes but their overall activity during the daily cycle affords an excess of oxygen production.

In deeper lagoons the lower layers of water contain no dissolved oxygen throughout the daily cycle. In all lagoons there is a bottom layer of sludge which is presumably biologically active since gas bubbles arise when the bottom is stirred. The gas contains little oxygen, carbon dioxide, or hydrogen sulfide. In the first lagoon at Killeen the sludge layer was estimated to be at least a foot deep. Anaerobic digestion in bottom sludge appears to be a second general feature of lagoon operation.

There is an additional reason to believe that bottom sludge digestion may be important in lagoon operation. Some lagoons, as at Edinburg, have no direct effluent and lose water only by seepage and evaporation. In the Killeen series, lagoons #3 and #4 were relatively clear and contained few algae although the preceding lagoons #1 and #2 had a heavy algae growth. In both the Edinburg and Killeen #3 lagoons there must occur a decomposition of algal cells, probably by settling and digestion with eventual loss of carbon and nitrogen to the atmosphere.

Present Status of Sewage Lagoons

The sewage lagoon is obviously adapted to the requirements of smaller communities where land costs are low and where the climate permits year-round growth of algae. Present information favors the following practices:

1. Pretreatment by primary settling. It is doubtful if further pretreatment is necessary unless the land area available for lagoon construction is limited or the BOD loading exceptionally high.

2. Use of lagoons in series operation. The first lagoon should be large enough and of such shape as to allow rapid mixing of the incoming sewage with the lagoon contents.

3. A depth of three to six feet. The most advantageous depth is not yet known.

4. A daily loading of about 40 pounds BOD per acre for the total lagoon system. At the time of observation the lagoon loading at Killeen of about 550 pounds BOD per day appeared to be adequately handled by the first three lagoons having an area of 10 acres.

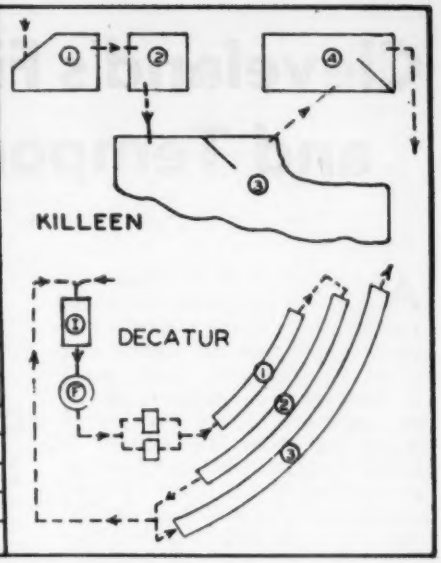
5. Lagoons are likely to be more

TABLE II—OPERATIONAL DATA ON THE KILLEEN LAGOONS

Twenty-four hour composite samples were taken from the effluents of each of the lagoons indicated. August 7-August 8, 1948. For the preceding month, an average flow of 745,000 gallons per day with a BOD of 91 entered the first lagoon. All data in ppm. Nitrite and nitrate nitrogens less than 0.1 ppm. No allowance is made for seepage or evaporation losses.

Lagoon	BOD	Ammonia Nitrogen	SUSPENDED SOLIDS			Total Alkalinity
			Total	Volatile	Fixed	
1	50	14	74	68	6	250
2	30	10	64	52	12	230
4	11	10	21	15	6	250
5	16	0.5	124	100	24	160
6	27	2	76	62	14	180
8	30	0.2	304	96	208	150

	STATION OR LAGOON	BOD IN PPM	TOTAL BOD LOAD IN LBS	BOD LOAD IN LB/AC	SURFACE AREA IN ACRES	% BOD REMOVAL
KILLEEN	LAG. NO. 1	91	562.5	124	4.52	45
	LAG. NO. 2	50	309.0	65	4.75	39.8
	LAG. NO. 3 & 4	30	185.5	16.1	11.46	63.4
	EFFLUENT	11	68.1	X	X	X
	OVERALL	X	562.5	27.1	20.75	88
DECATUR	RAW	428.5	407	X	X	X
	RECIRCULAT.	30	43	X	X	X
	IMHOFF	189	450	X	X	14.45
	FILTER	16.3	385	X	X	33
	LAG. NO. 1	66.3	158	121.5	1.3	48.7
	LAG. NO. 2	34	81	54	1.5	11.7
	LAG NO. 3	30	28.5	18	1.78	33
	EFFLUENT	20	18.9	X	X	X
	OVERALL-LAG.	66.3	158	34.5	4.57	68
	OVERALL-PLNT AND LAGOONS	428.5	407	X	X	95.4



Above, results of study on Killeen and Decatur lagoons; right, layout of lagoons. Flow at Killeen is 0.745 mgd.; at Decatur 0.114 mgd. plus 0.175 mgd. recirculation.

dependent on weather conditions and less consistent in operation than sewage plants of conventional design. Most field studies are made under advantageous weather conditions. Some safety factor against variation in lagoon behavior may be desirable.

6. Lagoons should be constructed in such a way as to permit maximum flexibility in operation and to aid in experimental study. Outlet boxes, for instance, should be designed to allow control of depth and to permit the use of weirs for accurate flow measurements.

7. The essential merit of lagoon sewage treatment lies in low construction and maintenance costs. The possibilities of improvement in operation by recirculation or by illumination at night deserve study but the gain factor must be great before such improvements can be economically justified.

8. Lagoon sewage treatment has a possible contribution to biological conservation, as use of effluent for irrigation of grain and forage crops, fish-farming, or other utilization. The lagoon at Temple discharges about 600 pounds dry weight of algae per day.

Lagoons may be used profitably to handle the effluents from conventional plants. Here they provide an additional safety factor in treatment, a standby against occasional plant failure, and an insurance against overloading.

Problems in Need of Early Solution

The most difficult and pressing problem of lagoon operation arises from the lack of any practicable measure of adequacy of treatment. The five-day BOD, as conventionally determined, gives a measure of the total oxygen demand including that required by the algae in the dark. Normally, however, the algae will increase rather than decrease the oxygen of a stream. The problem has recently been pointed out by Abbott (4) who has also suggested in principle a differential BOD requiring duplicate determinations in light and darkness. While sound in principle, the proposed method would be difficult to standardize.

The extent to which the algae may influence the BOD may be seen from a sample calculation. Many lagoons show an algal concentration of about 0.5 cubic millimeter of cells per cubic centimeter. From laboratory data a conservative estimate of rate of dark respiration by the algae is about 0.5 cmm. 0_2/hour/cmm. cells. Even allowing for a 1:5 dilution, the resulting 0.1 cmm. of cells/cc. will take up 1.2 cmm. 0_2/day or 1.6×10^{-6} gm. 0_2/day. Since the original cc. of water contained only about 8.0×10^{-6} gm. of oxygen it will be seen that an appreciable uptake in the BOD determination will be contributed by the algae. If the algae should show decomposition during the 5-day determination a still greater oxygen demand will result. So long as the algae themselves are not considered polluting material the conventional 5-day BOD (when determined in the dark) will always give a value too high because of the oxygen uptake of the algae themselves.

A second problem, the complete and accurate description of the biological mechanism, should be one starting point for future work. It would be most desirable to obtain a carbon and nitrogen balance on different lagoons of a system such as Killeen. This would require total carbon and nitrogen analyses on composite samples of influent and effluent and accurate measure of rates of flow. It would establish the extent of conversion of sewage organic matter to algal cells and the extent of subsequent loss of carbon and nitrogen to the atmosphere. Study of the biological activity of bottom sludge should also be made to determine its contribution to lagoon operation.

A number of other problems such as the effect of depth on lagoon operation, the effect of recirculation, the possibilities of illumination at night, and the possibilities of extension to industrial wastes all merit further study. In Texas the lagoon method of sewage disposal is now in an experimental stage. The method is theoretically, economically, and practically sound. Continued study is needed to provide a more accurate knowledge of advantages and limitations.

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Cleveland's Filtered Water Reservoir and Temporary Pumping Station

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AS long ago as 1920, it was realized that the greater Cleveland area eventually would require a new water supply near the easterly end of the City limits. A report, issued in 1930 based on studies made by the engineers of the Division of Water and Heat, Department of Public Utilities, City of Cleveland and reviewed by a Board of Consulting Engineers, called for completion of the 200-million gallon Not-

This vertical shale face was cut with a trenching machine.

tingham filtration plant, pumping station and intake, by 1935. As a part of this proposed project a 50-mg. filtered water reservoir consisting of two basins, each of 25 mg. capacity, was to be constructed.

At the time that these reports were made, and especially in 1930, the demand for water in the Cleveland Metropolitan Area was definitely on the upgrade. Hardly had this report been issued, however, before water consumption began to decline and nearly ten years had passed before the 1930 demand had been reached again. Nevertheless, in April, 1937, work was started on a WPA project for the rough excavation of the greater part of the Nottingham filtration plant and on the construction of certain portions of it.

Included in this project was the rough excavation for the filtered water reservoir. Work on this started September 1, 1937, and was completed December 1, 1938. During this period the WPA removed over 200,000 cu. yds. of material, most of which was shale, and nearly all of which required shooting. The work was done with power shovels and dump trucks, and was not carried lower in elevation than 2 feet above finished grade. Except for weathering, the excavation remained in this condition until the contractor started work last year.

Reservoir Operation

As previously noted, this reservoir will ultimately function as a part of the Nottingham filtration plant. It is the first large unit of this project to be placed under contract. However, it will be several years before these other units (including a new intake and crib) will be ready for service, and in the meantime the demand for water in a part of the area which this plant will supply has increased rapidly. To help meet this demand until the project is completed, the Nottingham reservoir will be filled during periods of low consumption and the water will be pumped back into the system during periods of high consumption. Hence the need for the temporary pumping station as a part of the reservoir contract.

Description of Reservoir

The Nottingham filtered water reservoir (South Basin) is a reinforced concrete covered structure approximately 315 feet by 535 feet in plan and with an average water depth of approximately 22 feet. As ultimately operated, water will enter through an inlet gate house at the northeast corner of the south basin, flow through openings in an influent channel wall, then westerly across the basin to an effluent collecting conduit. This conduit leads to the effluent gate house by which the water leaves the reservoir on its way to the permanent pumping station. Until the reservoir functions as a part of the Nottingham filtration plant, the water will enter and leave the basin near the temporary pumping station.

The roof of the reservoir is of flat slab construction, 9½" thick except at the drop panels, which are 14". The roof is supported by columns spaced, in general, 20 ft. on centers. The columns are doubled in each direction at the expansion joints and are 7' 6" on centers. All columns are reinforced and, except at the influent channel wall, are round and 22" in diameter. The columns rest on independent footers 18" thick for single columns and 2' thick for double or quadruple columns. In each case, a 3" ledge is provided on which the floor rests. Single column footers are of plain concrete; the others are reinforced. To simplify construction all columns are of the same length. The floor of the reservoir consists of 9 plain concrete blocks, the majority of which are 20' square except where the corners are cut off at the single column footers. To allow for expansion of the concrete and to prevent leakage at construction joints in the floor, ¾" fiber pads separate adjacent sections of concrete and the upper 4" of each joint is filled with "Noah's Pitch."

Typical steel reinforcing for side walls.

The walls of the reservoir are of the cantilever type. Except for the dividing wall between the two basins, all walls are backed to varying heights by undisturbed shale. In analyzing the walls for stability this shale backing was taken into consideration. The dividing wall was designed to be stable with water in the reservoir and no backfill in place. This was done to permit keeping the reservoir in service during future construction of a north basin.

The inlet and outlet gate houses are so designed that, after the north basin is built, water can enter into or leave directly from each basin; or by proper manipulation of sluice gates, either basin may also be by-passed. Each gate house has five 5′ x 7′ sluice gates to permit this procedure. Stop plank grooves and stop planks are also provided to permit making repairs to the sluice gates.

Expansion Joints

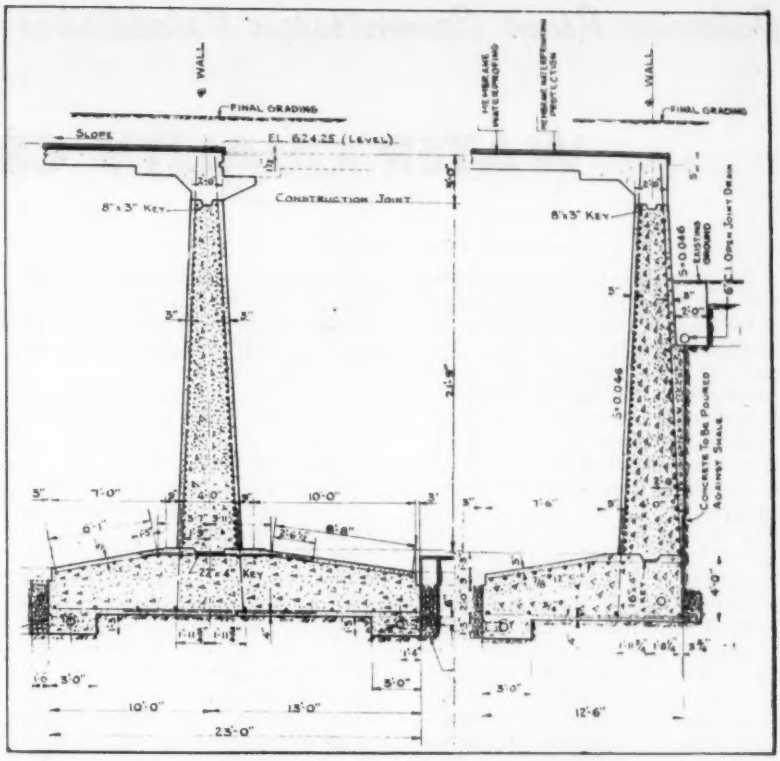
Expansion joints were placed in the walls, wall footers and roofs. These consisted of ⅜″ steel plates 16″ wide, approximately half of which was embedded in the concrete of the first section of wall, footer or roof placed, and the other half of which was coated with "Noah's Pitch," to permit sliding in the corresponding adjacent concrete sections. Provisions were made at the end of the sliding half of the steel plate to permit expansion of the concrete and ¾″ fiber pads coated with "Noah's Pitch," separated adjacent sections of concrete, for the same purposes. As in the construction joints, the upper part of each expansion joint was filled with Noah's Pitch.

Drainage

Drainage collection pipes were provided in the footings of all walls and at the shale line where wall concrete was placed against the shale. A drain was also placed under the center of the reservoir floor. In general, the drains in the footers were 6″ cast iron pipe, with tees placed on 21′ centers. The pipe was so laid that a lead joint occurred at each expansion joint. The face of the bell on the branch of each tee was placed flush with the face of the concrete, and a pocket for collecting seepage was cut in the shale opposite each tee and filled with broken stone. A grating in the bell of the tee prevented the broken stone from entering the drain. The drains at the shale line and under the reservoir floor consisted of plain end cast iron pipe with open joints, laid in broken stone. All of these drains lead to a common drain chamber.

Drainage was also provided on top of the reservoir by sloping the roof so as to form valleys leading to collecting points at the east and west walls, and covering the entire roof with a 3″ layer of broken stone. A layer of earth 21″ thick was placed over the broken stone. From the east and west collecting points the water was conveyed through cast iron drains, to the nearby creek.

With the exception of the water collected on the roof, which flows by gravity into the creek, all other drainage has to be pumped. A study was, therefore, made of the amount of such water for which it would probably be necessary to provide pumping equipment. Other reservoirs in the Cleveland system having generally similar conditions formed the basis of this study.



The north or dividing wall, at left, is designed to be stable without backfill. Typical side wall is shown at right above.

Ventilation and Roof Protection

Ventilation for the reservoir is accomplished by twenty-one 24″, two 36″, and one 48″ ventilating manholes in the roof. Ventilation in the gate houses is provided in the same way.

In order to protect the filtered water in the reservoir from possible contamination through the roof, the entire roof is covered with a membrane water proofing. Asphalt plank is laid on top of the water proofing, embedded in asphalt, with all joints filled with the same material. The broken stone previously mentioned rests on top of the asphalt planks.

Temporary Pumping Station

The pumping station is about 24′ x 68′ in plan, of which the pump pit occupies over 60%. The footers, walls, floors and pump foundations are of concrete. The superstructure is of the prefabricated metal type and is provided with structural steel columns supporting a crane rail. A two-ton, top running, hand geared, crane trolley type chain hoist is to be included. Three motor driven, centrifugal pumps, each with a capacity of 6 mgd. are provided. The contract also includes heating, plumbing, lighting, wiring, sump pumps, and gauges and other instrumentation.

Construction

The first work started by the contractor during 1947 was aimed at the removal of the remaining shale in the reservoir area to a level not closer than 6″ from the general finished grade under the floor. He was able to do this with power shovels augmented by cranes for loading the loosened material into trucks. The remaining shale, as well as that in the column and wall footers, was loosened with air hammers and excavated to grade

(Continued on page 53)

Potomac River Commission Establishes

WATER QUALITY CRITERIA

The Interstate Commission on the Potomac River Basin was organized in 1941 under a compact between the States of Maryland and West Virginia, the Commonwealths of Virginia and Pennsylvania and the District of Columbia for the control and abatement of pollution of the Potomac. With the cooperation of the states of the basin, the commission has formulated water quality criteria which may be used as a guide for measuring the quality of water in the basin's streams, has mapped the existing conditions of the different streams in terms of these criteria, has outlined a recommended first step in a progressive stream improvement program, and has recently published a 28-page pamphlet giving this information. These criteria will enable the proper state agencies to put the Potomac compact into action and to enforce uniform regulations for every specific area. They are not to be considered as placing in any way an ultimate or final objective on any section of the stream.

In preparing these criteria the commission has been governed by the assumption that it is undesirable to set rigid standards, but only such as can be used as a guide of water quality when all conditions affecting water purity are considered; that the criteria should be for minimum requirements only, should be reasonable in the light of present-day knowledge and such as can be met within the limits of present-day treatment practices; and should be easily determinable.

The various water areas in the basin are divided into four classes: Class A—Waters suitable for a potable water supply with no treatment necessary except chlorination or disinfection. They may be used also for bathing, fish life, recreation and industrial processes. Class B—Satisfactory for domestic supplies with complete treatment, for industrial process water, and for bathing and other recreational purposes. Class C—Same as Class B except not suitable for bathing, recreational purposes and fish life. Class D—Having a satisfactory general sanitary condition, creating no nuisance in the surrounding area and in no way affecting public health unless used for domestic water supplies or for swimming purposes. Can be used for navigation, as cooling water, and for similar purposes.

The criteria adopted for the several classes are shown in the accompanying table.

Minimum Water Quality Criteria for Streams in the Potomac River Basin

	Class A *Drinking Water* (No treatment except cl.)	Class B *Bathing, Fish Life Recreation*	Class C *Industrial Process Water Domestic Water Supplies* (Before complete treatment)	Class D *General Sanitary Condition to prevent nuisance*
Coliform Bacteria MPN per 100 ml.	0 to 50	Monthly av. 50 to 500 Max. not over 1000	Monthly av. 500 to 5000	———
Color, ppm	0 - 10	20 (desirable)	Amt. of color and turbidity allowed which can be removed by standard equipment and practices.	———
Turbidity, ppm	0 - 10	40 (desirable)	———	———
pH	6.0 to 8.0	6.0 to 8.5	6.0 to 8.5	6.0 to 8.5
5 Day B. O. D., ppm				
Monthly av. ppm	———	1.5	2.0	3.0
Max. observ. ppm	———	3.0	4.0	5.0
Dissolved Oxygen, ppm				4.0
Monthly av. ppm	7.5	6.5	6.5	Min. daily av. 3.0
Min. observ. ppm	6.5	5.0	5.0	Absolute min. 2.0
Other Conditions	No toxic substances, oils, tars, or free acid at any time. No floating solids or debris, except from natural sources. No taste — or odor - producing substances. No sludge deposits.	Same as A	Same as A	No toxic substances, oils, tars, or free acid at any time. No floating solids or debris, except from natural sources. Slight localized sludge deposits, if unpreventable, allowed. No offensive odors.

NOTE: These criteria are to be used only in conjunction with a sanitary survey as a guide in determining the minimum water quality for the various classes of water use listed. It is intended that these criteria should apply to conditions which are expected to prevail for the major part of the time.

247 County Engineers Tell

What Is Their Most Useful Equipment

Labor-saving, which means these days money-saving, equipment for highway and bridge construction is available. Using such equipment invariably develops more and better ways of utilizing it. Here is first-hand information, summarizing experiences from all over the country for better employment of modern types of equipment.

IN a recent questionnaire, county engineers and others in charge of county highway work were asked "What piece or type of equipment has been most useful in maintenance and/or construction?" In all, 651 replies were received, of which 444, or 69% answered this question specifically. In this installment, 247 replies are summarized. These represent the answers in the first 367 questionnaires returned and are typical of the entire country.

Counties report using all kinds of maintenance and construction equipment but motor graders are the outstanding favorite, with front-end loaders a good second. The replies have been grouped under appropriate heads, the exact words of the replier being generally used, and his name, title and address given. Where more than one piece of equipment was mentioned, replies have sometimes been placed under the "Miscellaneous and General" heading.

Motor Graders Ahead for Maintenance

The total of preferences and mentions of motor graders and maintainers was 173, coming from practically every state. Following are some of the replies: Motor grader for maintenance; tractor and scraper for construction—J. M. Holt, Chairman, Board of Revenue, Athens, Ala. Motor graders for maintenance and construction of clay-gravel bases for bituminous surface treatments—Lewis J. Moore, Jr., County Engineer, Selma, Ala. Motor graders for earth and gravel road maintenance—R. W. Haselwood, Co. Surveyor and Rd. Comm'r., Alturas, Calif. We use motor graders efficiently for blading earth roads, shoulder construction and road mixing of bituminous surfacings—J. H. Mack, Surveyor and Rd. Comm'r., San Diego, Calif. Motor graders for smoothing and maintaining roads, constructing grades and removing snow—Jay E. Painter, Co. Engr., Idaho Falls, Idaho. Patrol grader, self-propelled; 10-yd. scoop with tractor and crane, in order named for both construction and maintenance—S. W. Ogden, Co. Supt. of Hwys., Cambridge, Ill.

Motor patrol and medium tractor with truck loader—Walter C. Dye, Co. Supt. of Hwys., Danville, Ill. Auto patrols for grading, backsloping and shaping earthwork construction, scarifying, leveling, snow removal and maintenance—C. O. Brownlee, Co. Supt. of Hwys., Shelbyville, Ill. (1) Motor graders, (2) Bulldozers, (3) Dragline—L. E. Clayton, Co. Engr., Fairfield, Ia.

Motor patrol for ditching, maintenance and snow removal—H. C. Hildebrand, Co. Engr., Ashland, Kans. Motor patrols, used in pairs for both grading and maintenance—Ralph E. Campbell, Co. Engr., Hugoton, Kans. Motor graders for construction and maintenance—Ernest Royer, Co. Engr., Leoti, Kans. Motor patrols for construction and maintenance—Richard Meyer, Co. Engr., Osborne, Kans. Motor graders, track type tractors, scrapers and dozers—Edwin P. Knapp, County Engr., Smith Center, Kansas.

Patrol graders for maintenance and construction; also ½-yd. shovel for handling gravel surfacing, etc.—Frank D. Tyson, Co. Engr., Stockton, Kans. Motor graders for general maintenance—D. M. Humble, Rd. Engr., Danville, Ky. Power patrol grader with conveyor loader attachment—Irvine D. Stapp, Co. Rd. Engr., Lancaster, Ky. Motor graders—R. H. Stodghill, Co. Road Engr., Morganfield, Ky. Our power grader is useful for both ditching and shaping, along with a force feed loader to handle surplus dirt into trucks, as drainage is the most important part of road maintenance—C. H. Proctor, Co. Rd. Engr., Shelbyville, Ky. Motor grader for shaping roads, ditching, backsloping, mixing and laying bituminous materials—K. L. Hallenback, Supt. & Mgr., Washtenaw Co., Ann Arbor, Mich. Motor grader to cut off shoulders that are so built up as to keep water from reaching road ditches—Laverne J. Hendryx, Engr., Cassopolis, Mich.

Auto patrols for construction, all types of maintenance, filling washouts, etc.—Harold Smith, Supt., Bellaire, Mich. Motor grader for turnpiking roads and snow removal—R. W. Stine, Supt. of Maintenance, Van Buren, Mich. Motor grader and mobile crane for maintenance and construction—R. H. Dueltgen, Supt., Rogers City, Mich. Patrol graders for year-round work, maintenance in summer, snow plowing in winter—L. B. Bjosted, Co. Engr., Cambridge, Minn. Large power graders for general maintenance, mixing bituminous materials and snow removal—G. W. Deibler, Co. Hwy. Engr., Duluth, Minn. Motor patrol grader for maintenance, reshaping, cleaning ditches, snow plowing and other work—J. R. MacQueen, Co. Hwy. Engr., Pine City, Minn. Power grader for blading, reshaping and snow plowing—J. G. Merten, Co. Hwy. Engr., Stillwater, Minn.

Equipment Voted Most Useful by Counties

MOTOR GRADERS
FRONT END AND OTHER LOADERS
BULLDOZERS
DRAGLINES, POWER SHOVELS, Etc.
SCOOPS AND SCRAPERS
TRACTORS
CRUSHERS
DISTRIBUTORS, SPRAY UNITS, Etc.
PULVERIZERS, Etc.
TRUCK BLADES
ROTARY SNOW PLOWS
MOTOR TRUCKS
ELEVATING GRADERS
PAVERS
ROLLERS

Photo from Caterpillar

Motor graders mix and spread black-top.

Motor patrols for dirt road maintenance—C. C. Redman, Jr., Co. Engr., Kennett, Mo. Our 5 motor maintainers have done more toward keeping our gravel roads in shape than all other equipment—Geo. H. Vossbrink, Hwy. Engr., Union, Mo. Power grader for maintenance and repair, scraping shoulders, scarifying and other work—Edward H. Maier, Co. Engr., Bridgeton, N. J. Motor grader —R. E. Shorter, Co. Supt. of Roads, Morristown, N. J.

Grader for ditching, bank sloping, trenching, loading from stock pile and other work—Gail Ball, Co. Supt., Auburn, N. Y. Power grader for scraping gravel roads, leveling, mixing retread, trimming shoulders, ditching and scraping icy pavements — Robert P. Carrier, Co. Supt. Hwys., Batavia, N. Y.

Our most versatile machine is the motor grader with snow plow and bulldozer—J. W. Harty, Co. Engr., Grand Forks, N. Dak. Tandem motor grader and 10-ton roller—John E. Porter, Dir. of Public Service, Galion, Ohio. Grader for road work and snow plowing—Walter W. Johnson, Co. Engr., Marion, Ohio. Grader for ditching, sloping, berming, loading —Harry L. Dittmer, Co. Engr., Warren, Ohio. Motor graders for snow removal, maintenance and construction—D. L. Best, Road Master, Baker, Oregon.

Patrol graders for maintenance of our 500 miles of sand clay roads—A. T. Brown, Sr., Co. Clerk, Sumter, S. C. Diesel motor grader, with snow plow and wing on snow removal and on road construction in summer—Early Coyne, Hwy. Supt., Brown, S. Dak. Motor grader for ditching and maintenance—Carroll Shelton, Prec. Comr., Pittsburg, Texas. Motor patrol graders for ditching, grading, smoothing gravel roads, bituminous construction and snow plowing—F. D. Johnson, Janesville, Wisc. Motor grader for all-around reshaping, ditching, snow plowing and widening —Richard A. Smith, Co. Hwy. Engr., Madison, Wisc.

Loaders Are Widely Used

Front-end and other loaders, including force feed, have an amazingly wide acceptance among county engineers. This is not surprising in view of the many uses that counties have found for these units. In the following paragraphs, an attempt has been made to include answers which indicate the many uses of this equipment.

Power loader for maintenance, covering pipe, repairing washouts, etc. —Milton Lurie, Co. Engr., Dothan, Ala. Front loader for loading sod from shoulders of paved highways—John B. Carson, Div. Engr., Dover, Del. Tractor with front-end loader used in cleaning ditches—Paul W. Fenity, Supt. of Hwys., Carrollton, Ill. Front-end loader for cleaning ditches, excavation for culvert installation, back-filling for culverts and bridges, and loading trucks with road materials —S. C. Campbell, Co. Supt. Hwys., Mt. Carroll, Ill. Motor grader for surface, both construction and maintenance; loader for ditch reconstruction on surfaced roads—M. W. Phillips, Supt. Hwys., Mt. Vernon, Ill. Tractor loader which does all odd jobs, ditch cleaning, quarry operation, etc. —Harold R. Oscher, Co. Supt. Hwys., Nashville, Ill. Tractor loader; due to shortage of surface material this loader has been of greatest value in salvaging waste material to take place of hard-to-get crushed stone—N. Chambers, Act. Supt. Hwys., Pinckneyville, Ill. Power force feed loader, self propelled, which we use for loading dirt from berm and ditches—Everett Lanham, Co. Surv. & Hwy. Supt., Greensburg, Ind. Our most useful pieces of equipment are our power loader and our light ⅜-yard dragline—L. W. Croft, Co. Engr., Adel, Iowa. Front-end loader picking up gravel ahead of construction crews—C. Arthur Elliott, Co. Engr., Jefferson, Iowa.

Tractor-loader to handle and load gravel from pit—Frank B. Reeves, Co. Engr., Hiawatha, Kans. Front-end loader for cleaning road ditches, excavating for culverts and loading materials—E. E. Larson, Co. Engr., Lawrence, Kans. Tractor loader for excavating, dozer work, loading trucks; also have pile driver attachment—H. A. Bute, Co. Engr., Ness City, Kans. Power loader for ditching, and motor graders—L. E. McCartt, Co. Engr., Covington, Ky. Our 3 tractor front-end loaders—Blanton Barnett, Jr., Silver Springs, Md. Power loader for cleaning ditches and removing high shoulders —J. H. Dennis, Co. Engr., Flint, Mich. Belt loader for cutting off high shoulders and salvaging materials on construction work—Robert F. Lunde, Co. Engr., Ludington, Mich.

Wheel tractor with loader plus 4 additional home made loaders—D. D. Carlson, Co. Engr., Aitkin, Minn. Light tractor with front-end loader and dozer—F. D. Turnacliff, Co. Engr., Mora, Minn. Tractor excavator, used for installing culverts, loading trucks, cleaning ditches and handling heavy materials; also with one-way snow plow—C. W. Turnell, Co. Hwy. Engr., Red Lake Falls, Minn. Mobile front-end loader on shoulders, ditches and material handling — J. Bruce Orr, Co. Supt. Hwys., Binghamton, N. Y. Mobile loader for ditch cleaning and shoulder maintenance in combination with power grader—Gordon Chester, Co. Supt. Hwys., Canandaigua, N. Y. Rubber tired tractor with hydraulic loader—G. J. Oram, Co. Supt., Carmel, N. Y. Power loader—Malcolm McPherson, Co. Supt., Delhi, N. Y.

Power loader used in handling berm dirt—Luther K. Zerbe, Co. Engr., Canton, Ohio. Mobile loader for ditch work—C. W. Stacy, Co. Engr., Marietta, Ohio. Power loader for side road maintenance—W. D. Terry, Co. Engr., Norwalk, Ohio. Front-end loader and crane for loading stone, dirt and gravel, berm work and bridge construction—M. W. Beckberger, Co. Engr., Sandusky, Ohio. Front-end loaders—J. S. Clark, Res. Engr., Newkirk, Okla. Force loader for ditch and shoulder cleaning—T. R. Hartrampf, Roadmaster, Hillsboro, Ore. Power loader—K. F. Jones, Co. Engr., Port Townsend, Wash. Tractor front-end loader for handling rock, cleaning ditches, etc. —Paul A. Hartwig, Co. Hwy. Comr., La Crosse, Wisc.

Draglines and Power Shovels

Power shovels and draglines are all-around units which can do a great variety of jobs—handling timbers and other heavy objects, driving piles, loading materials, trenching, cutting channel changes, widening, cleaning ditches, and digging

trenches. The answers testify to their usefulness.

Dragline excavators, pile drivers, dump trucks, bulldozer units and motor graders combined — Vaughn Wood, Co. Rd. Comr., El Centro, Calif. Half-yard crane with pile-driving attachment used in replacing timber structures—H. A. Kluge, Co. Supt. of Hwys., Edwardsville, Ill. Light dragline and tractor front-end loader producing and loading pit gravel—A. P. Rosche, Co. Supt. Hwys., Hillsboro, Ill. Mobile ⅜-yd. dragline and power loader—L. W. Croft, Co. Engr., Adel, Iowa. Truck-mounted crane with dragline and clam bucket used for all kinds of work—G. Sherman Held, Co. Engr., Guthrie Center, Ia. Mobile dragline used for pile driving, culvert excavation and cleaning ditches—R. J. Gibson, Co. Engr., Mt. Ayr, Ia. Half-yard dragline used by bridge crews for driving piling and placing culverts—R. A. Rawlings, Co. Engr., Onawa, Ia. Dragline, ⅜-yd., and crane unit mounted on rubber, used to load gravel and for construction—H. L. Gibson, Co. Engr., Winfield, Kans. Small shovel for handling gravel—F. C. Smith, Surveyor, Campbellsville, Ky.

Truck crane for unloading cars, loading gravel, loading fill dirt, cleaning ditches, driving piling and excavating for bridges — Roy De Haven, Engr., St. Joseph, Mich. Light mobile crane for ditching, culvert work and loading—A. Paul Kreager, Engr., Caro, Mich.

Truck crane for loading gravel and digging dirt—L. B. Levin, Co. Engr., Sault Ste Marie, Mich. Power shovel, dragline and rock crusher—J. S. Wagnild, Hwy. Engr., Windom, Minn. Truck crane—L. R. Bennett, Co. Supt. Hwys., Bath, N. Y. Power graders and shovels for graveling county and town roads preparatory to placing low cost surfaces—Herrick Osborne, Co. Supt. Hwys., Warrensburg, N. Y.

Power shovel on FWD truck, 2 motor graders and bituminous distributor—Roy E. Watson, Dep. Co. Engr., Delaware, Ohio. Light ½-yard shovel for pile driving, channel changes, and material handling—W. H. Veatch, Co. Engr., Mt. Vernon, Ohio. Crane used on bridge and channel work—A. J. Moon, Co. Engr., Upper Sandusky, Ohio. Power dragline and crane—W. H. Metzler, Co. Engr., Wooster, Ohio. Draglines for loading gravel; motor graders for dirt road maintenance—J. S. Griffith, Co. Engr., Hempstead, Tex. Draglines for ditching and maintainers for gravel roads—Charles Schultz, Co. Judge & Engr., Richmond, Tex. Truck mounted ½-yd. shovel—H. F. Donnelly, Co. Engr., Republic, Wash.

Bulldozers Excel for Clearing and Grubbing

The many jobs that bulldozers can do are as valuable in county highway construction as in any other field. The bulldozer is the jack-of-all trades for meeting many difficult conditions.

Bulldozers for clearing road right of ways and building stock ponds for farmers—I. O. Gayler, Co. Judge, Stone Co., Mountain View, Ark. Bulldozers — for smoothing hummocky land, and for road construction and grading—C. G. Bailey, Co. Surv., Key West, Fla. Bulldozer for grading and for excavating for lakes and other structures; also find portable pump very valuable—W. P. Johnson, Co. Surv., Douglasville, Ga. Dozers and scrapers for construction; motor patrols for maintenance—T. J. Bonderes, Co. Supt. Hwys., Monmouth, Ill. Crawlers, scoops and bulldozers—Hugo Benefiel, Co. Engr., Creston, Ia. We have found that our 3 bulldozers are probably the most valuable equipment we own—John F. Berry, Co. Engr., Toledo, Ia. Dozer-shovel for installing pipe culverts, filling washouts, making small fills, loading sand and gravel and cleaning ditches—F. S. Williamson, Co. Engr., Council Grove, Kans. Dozers for rock removal and dirt handling—K. J. Loftig, Co. Engr., Eureka, Kans. Dozer on tractor grubbing stumps, filling washouts, and installing culverts—Glen C. Bickley, Co. Engr., Center City, Minn.

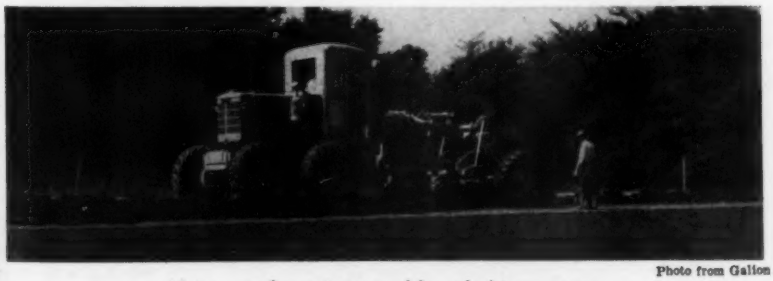


Photo from Galion

Motor grader stripping old asphaltic concrete.

Tractor and dozer for construction work—W. M. Morrison, Co. Engr., Gainesville, Mo. Tractor and dozer with carry-all scraper for raising grade, bulldozing off high places and clearing snow—W. P. Burke, Red Lodge, Mont. Tractor with 8-yard scoop and 10-ft. bulldozer—E. J. Eichelberger, Hwy. Comm., Broken Bow, Nebr. Tractor and dozer—E Lee McKinney, Co. Engr., Madill, Okla. Dozer—T. H. Baldwin, Co Engr., Cheyenne, Wyo.

Distributors, Sprayers and Crushers

400-gal. distributor-trailer mounted maintenance oiler which we use for general maintenance—E. R. Hanna, Co. Rd. Comr., Hollister, Calif. Bituminous distributor for surface treating roads—L. B. Brandon, Co. Engr., Meridian, Miss. Bituminous patching outfit for maintenance of our oiled roads—W. W. Larsen, Co. Engr., Albany, Oregon. One-man patrol grader and 800-gal. 2-wheel pull distributor—Cleo Swecker, Sr. Engr., Keyser, W. Va.

Rock crushing plant, material used for surfacing—L. J. Schlitz, Co. Engr., Dubuque, Ia. Stone crushers, also motor graders and bulldozers—R. Lee Beeler, Co. Rd. Engr., Nelson, Ky. Gravel processing plant—C. B. McBride, Co. Supt. Hwys., Falconer, N. Y. Rock crushers for road surfacing—W. M. Hector, Co. Engr., Klamath Falls, Oregon.

Other Types of Equipment for Special Work

Special problems are always arising which need quick and economical solution. Here are some of the views of our readers on equipment they have used to solve such special problems.

Special mixers for mixing dust-oil road surfaces—Arthur J. Snell Co. Rd. Comr., Visalia, Calif. Pulverizing mixer for constructing sand-bituminous pavements — W. Glenn Gibson, Co. Engr., Fort Myers, Fla. Scoop and tractor, and crane, after motor grader—S. W. Ogden, Co. Supt. Hwys., Cambridge, Ill. Tractors, scoops and bulldozers—Hugo Benefiel, Co. Engr., Creston, Ia. Power pulvimixer—M. Y. Kinne, Co. Engr., Webster City, Ia. Dirtmoving 10-yd. scoop, and tractor with a tractor shovel for installing culverts and making fills—Ivan L. Welty, Co. Engr., Hill City, Kans. 2-ton trucks for hauling gravel, 7½ to 10-ton trucks for snow plowing, crawler tractors for construction—Carl Tyler, Supt., Cadillac, Mich.

Six-ton truck and rotary for snow

removal and large motor graders for all-round snow plowing and maintenance—M. M. Nygaard, Hwy. Engr., Crookston, Minn. Possibly rotary snow plow equipment—A. B. Klessig, Fairmont, Minn. The regular maintenance equipment; but this year we have made good use of a steam jenny both for cleaning equipment and thawing frozen culverts—G. A. Anderson, Co. Hwy. Engr., Gaylord, Minn. Motor patrols, power shovels, gravel crusher, tractors and bulldozers—V. T. Kenna, Co. Engr., Grand Marais, Minn. Most useful single piece of equipment is a new rotary plow mounted on a truck—John S. Schmit, Hallock, Minn. Tractor and scraper—Claude Zehetner, Co. Hwy. Engr., Ivanhoe, Minn. Bituminous paver—Harry S. Bronson, Co. Engr., St. Paul, Minn.

Elevating grader for road construction—Carl Lemmer, Co. Surv., Great Falls, Mont. Motor patrol and 8-yard scraper, tractor and scoop for maintenance and construction—W. A. Racely, Co. Surv., Pender, Nebr. Drop inlet corrugated metal culverts and arches which reduce maintenance costs and prevent erosion—Frank P. Dall, Co. Surv., Plattsmouth, Nebr. Bituminous paving spreader—James C. Tomasulo, Chf. Clerk, Rd. Dept., Westfield, N. J. Motor graders, pull graders, trucks and power loader for maintenance; bulldozer and shovel for construction—F. C. Frear, Co. Engr., Roseburg, Ore. We have 43 pieces of equipment and all are necessary—Earle Holloway, Hwy. Supt., Brookings, S. Dak. Crawler tractor with scrapers—P. R. Phillips, Hwy. Supt., Huron, S. Dak. Maintainers for maintaining road surfaces; bulldozers for clearing growth and timber and leveling for new construction—D. W. Shields, Jr., Chairman, Hwy. Comm., Manchester, Tenn.

Undertruck blades, which we use not only on gravel roads, but also on earth roads and trails; they give a usable surface at minimum cost—G. F. De La Mater, Co. Engr., Gaylord, Mich. Hard to say what is best but I believe the most used equipment are the power grader, bulldozer and power loader—F. R. Lemcke, Co. Engr., Xenia, Ohio. Tractors and motor graders—Harlee Morrison, Co. Judge, Kaufman, Tex. Motor maintainer and power scrapers—Noble James, Co. Engr., Lubbock, Tex. Motor grader and power feed loader for ditch maintenance and grading—Frank Fawcett, Res. Engr., Luray, Va. (1) Power loader to clean ditches, (2) truck mounted shovel-dragline-crane-pile driver—B. Loyal Smith, Co. Engr., Walla Walla, Wash. Power driven bucket loader for loading mine tailings for road repairs and surfacing—George E. Elderson, Comm., Darlington, Wisc. For maintenance a good windrow loader; for construction the 11-yd. scraper—George Batty, Hwy. Comr., Portage, Wisc.

General Statements

Coordination of the several units is always necessary—Claude J. Rogers, Co. Engr., Birmingham, Ala. The greatest gain has been in careful coordination of standard equipment—J. B. Manthey, Co. Surveyor & Engr., Stockton, Calif. An impossible question! Our most used equipment: Power excavator at gravel pit; crawler loader cleaning ditches; bulldozer on construction; pile driving outfit on bridges; and motor patrols on maintenance—James G. Cooney, Co. Supt. Hwys., Carlyle, Ill.

We have purchased two ½-yd. draglines and a bulldozer for cleaning county road ditches—L. E. Captain, Surveyor, Bluffton, Ind. Motor grader, power loader, sand spreader, and pulvimixer—H. C. Austin, Co. Engr., Kansas City, Kan. (1) Motor graders, (2) Bulldozers, (3) Draglines—L. E. Clayton, Co. Engr., Fairfield, Iowa.

Diesel motor patrols for maintenance, cable controlled scoops for end work, dragline for ditching, loading gravel and bridge work—A. J. Van Sise, Co. Engr., Forest City, Iowa. Pile driver for bridge work; bulldozers for back-fill; draglines for channel work—Harold J. Pranter, Co. Surveyor, Nodaway, Mo.

Photo from J. D. Adams Co.

Photo from Allis-Chalmers

Photo from Austin-Western

Motor graders shown above are being used on general maintenance and construction.

Steps in REBUILDING A WATER FILTER

A. R. TODD
Supt. Filtration, Wheeling, W. Va.

Palmer agitator installed between washwater troughs at another water plant.

FILTERS, like other equipment, eventually become inefficient and need overhauling. The under-drainage, or collecting system, becomes clogged up; strainers and piping succumb to corrosion; sand grains grow from lime deposits and must be treated with acid or sulphur dioxide or be replaced, or the grains may become soft and pliable; gravel becomes mixed with the sand; or the sand grains become cemented together so as to prevent effective washing. For any of these reasons (and others) the time eventually comes when it is necessary to rebuild the filter. This article is written in the hope that others may profit from our experiences. There is no mystery connected with rebuilding filters—just common sense and a lot of hard work. The various steps follow in the order of their sequence.

Old Sand Removal

Some consulting engineers in designing filters failed to take into consideration the fact that some day the sand and gravel would have to be removed. Filters were designed with only the front half exposed, and with the half back extending under a concrete cover so low that a man shoveling sand has to work stooped over. Others have placed tank filters with the top of the filter a few inches from the roof of the building, leaving no room for a person to get into the filter. In any case, the first step is to remove the old sand. This can be done by shoveling the sand out and carting it away in wheelbarrows in the case of small filters. In the larger filters a sand ejector is used. In most cases it is cheaper to use new sand, or anthrafilt, than to try to reuse the old sand. We found it best to shovel the sand into the ejector hopper and to eject the sand to waste. Our filters contain 105 tons of sand and it takes our crew of four men 2½ days to remove this.

Handling Gravel

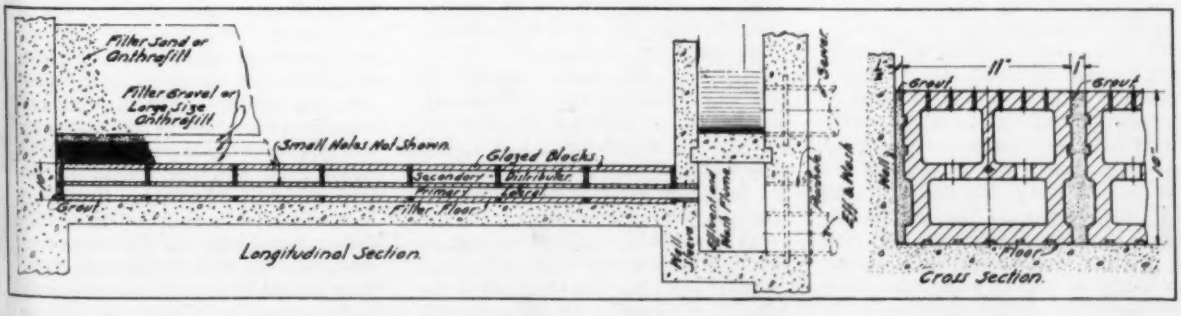
After the sand is removed, the gravel is next. Ejectors will not handle gravel and it is difficult to shovel gravel because you cannot get a shovel under the gravel on account of the drainage system. We built and used a belt and bucket conveyor for removing the gravel but discarded it in favor of an electric hoist of ½-ton capacity and two 20-gal. garbage cans on which we put handles. We shovel the gravel into the cans and raise them through the man-hole with the hoist, which is on a trolley and I-beam. We push the loaded can to the end of the beam and dump it. Two men on top and two below will remove the 65 tons of gravel from our filters in 3½ days.

The next step is to wire brush the concrete filter walls, clean and paint the filter troughs and do whatever drilling is necessary for the installation of Palmer sweeps. This is all done before starting on the filter bottom because of the dirt involved.

Filter Bottom

The water distribution system in the bottom of the filter is then inspected and overhauled. Some consist of strainers; others of perforated pipe or perforated brass plates; still others are of patented design. In constructing the filters in the Wheeling plant brass strainers were used. The bottoms of these were cast red brass and the top umbrella parts were of yellow brass sheet stampings. When we removed the sand and gravel, we found that the top part of the strainers had disintegrated. The first few filters we rebuilt we replaced these strainers with all cast strainers. However, during the war with the scarcity of brass we tried out Leopold glazed tile filter bottoms and we think so much of them that we have adopted them as standard. More will be said about these a little later.

Our filters are constructed with a false bottom, 18" above the regular bottom, and when we took off the manholes we found this space almost



Sections, showing installation of filter tile underdrains.

solid with sand. How to remove it presented quite a problem. We tried to wash it out with hoses but got absolutely nowhere because the bottom was level and the openings about three inches above the floor. We then tried using a sled, with a rope to pull the empty sled in and a rope to pull the loaded sled out. Working in a space with the ceiling 18" high made this awful slow work because the men could not use an ordinary shovel but had to use a small coal stove shovel. We then built a home made portable ejector. At the end of the suction we rigged two small water hose so that the water would squirt into the end of the suction hose. This worked fairly well but was cumbersome to move about as you had to move either the sand to the hose or push the hose into the sand. One day a new employee who didn't know any better (that is, did not know that water was necessary to move sand) left off the two small hoses and as a result was moving twice as much as we were moving before. We can now remove this sand in about three to five days where it used to take us two to three weeks. The men simply crawl along on their bellies, holding the 2" suction hose in one hand and reaching out and bringing the sand to the mouth of the hose with the other hand, in a sort of sweeping motion.

Rebuilding Procedures

After sand and gravel have been removed, the collecting system is inspected and strainer heads replaced if needed. Then a 6" layer of the 1½" to 2" size gravel is placed (larger sizes are sometimes used but are not necessary). This 6" layer, as well as the succeeding layers, should be carefully raked and leveled. It is followed with a 4" layer of ¾" to 1" size, and 4" of ¼" to ¾" size. The most important step is the placing of the pea size layer (⅛" to ¼"). This should be 4" in depth and care should be taken not to disturb this layer when adding the sand. Standard depth of gravel is 18" but 14" has been used with equal success. Next comes the sand. It is usually handled with an ejector and it is necessary from time to time to move the hose to keep the sand from piling up in one place. A sand depth of 30" is customary, but 27" and even 24" has been used successfully. A filter is nothing more or less than a finishing operation: 90% of the turbidity is usually removed by the sedimentation basins, leaving 10% for the filters. In plants where the filters are depended on for a high percentage of bacteria removal, a finer sand should be used but in plants with large settling basin capacities, and where the water is properly conditioned, a larger sized sand grain can be used with the advantage of faster filtering.

Leopold Bottoms and Anthrafilt

The advantages of Leopold Bottoms, Anthrafilt and Palmer Sweeps are many. In the first place, we feel that the glazed filter tile will last indefinitely, whereas all, or most all, other types will need attention sooner or later. The anthrafilt, too, should last a lifetime. Faster filtering results and less wash water is required to wash the filter. Our anthrafilt filters clean up in about 3½ minutes whereas it takes from 5 to 6 minutes on the sand filters. Also, from my experience, I would say that Palmer Sweeps are a necessity. The ease in which filters can be kept free from mud balls highly recommends them.

Our procedure in installing Leopold filter tile is as follows: After the sand and gravel are removed; the holes drilled in the filter walls for the installation of the Palmer Sweeps; the walls thoroughly brushed; and the troughs cleaned, we cut holes down through the middle of the filter. The holes are 6" x 6", 18" apart. Also a series of 2" holes are drilled on either side of this center strip to hold the anchor rods used on the center row of filter tile directly over the trough. Then 2 x 4s are placed on edge so as to leave a space of 18" down through the center of the filter. Wire mesh is then placed over the rest of the filter and fastened to the old strainers. The old strainers are not removed because they are ideal to fasten the mesh to. Then 4" of concrete is placed and after it sets up the center forms are removed. Beginning at the back of the filter the tile is then put in position starting with the center tile and working towards the ends. Care is taken to see that the anchor rods are in position and that the tile are evenly spaced. The tile are set in about ¼" of mortar and all the spaces between the tile are carefully filled with mortar, so that no air holes are left. Our filter area is 712 square feet and it takes our regular maintenance crew of four men eight days to complete the job. It is not necessary to use regular bricklayers because just as good a job can be done with your regular workers. The next step is the placing of the anthrafilt. We start with a 3" level layer of #5 (9/16" to 13/16") and follow with 4½" of #3 (3/16" to 5/16"), and 4½" of #2 (3/32" to 3/16"). These three layers, totaling 12", are equal to the 18" of gravel formerly used. We then place 27" of the #1 anthrafilt, being careful not to disturb the larger anthrafilt underneath. The filter is then washed six minutes; allowed to stand 24 hours; then filtered to waste at a low rate for two hours; then washed again. It is then ready for use. We use a crew of six men and two days are required to place the anthrafilt. Our total cost of filter rebuilding, including overhead, labor and materials (including Palmer sweeps) runs $5.60 per square foot at the present time.

Sedimentation Efficiency and Grit Removal

With an average detention period during 1947 of 0.9 hour, the settling tanks of the Minneapolis-St. Paul Sanitary District sewage treatment plant removed 69.6% of the suspended solids and 40.0% of the 5-day BOD. Sludge is pumped from the tanks 3 times every 24 hours. By close control of operation, the solids concentration in the sludge has been kept at an average of 8.03%.

During 1947, according to the annual report for that year, 0.8 cu. ft. of screenings, the same as the preceding year, was removed per million gallons of sewage; and 3.6 cu. ft. of grit, compared to 5.6 cu. ft. in 1946. At normal dry weather flows, velocities in the grit chambers are about 1.2 ft. per second, but during storm periods only about half as much.

Why the Digestion Tank Could Not Be Heated

Each winter for some years past it had been increasingly difficult to maintain desirable temperatures in Ann Arbor's 9-yr. old digesters, even though 150°F water was circulated through the heating coils. The digesters had never been cleaned, and it was thought probable that the primary contained considerable grit and sand, and that this might have something to do with the difficulty in heating it. After considerable difficulty the liquid was pumped out and 13 ft. of sand and grit found in the tank, which is 29 ft. deep. The heating coils were completely buried in the sand and were off their supports, mostly on the floor of the tank. They were jacked back onto their supports, and presumably it will now be possible again to heat the tank.

About 100 trailer lots are situated around each of the buildings shown at right. The trailer area is horseshoe shaped, with access provided by inner, outer and central drives and radial streets. Trailer lots average 35′ x 50′.

A TRAILER CAMP FOR VETERANS

L. T. BRUHNKE

IN ORDER to remove the trailers from their temporary sites so the parks and swimming pools will be available to the public, Milwaukee County has built a new trailer camp incorporating the experience gained in the past eighteen months. The location is in the western part of the county on highway 100, which loops and by-passes the city. When the emergency is over, the camp will either be used as a trailer camp for transients or as a park, as originally planned.

Before any trailers were moved, the entire project was completely planned for roads, sewers, water works, fire hydrants, electric lights, playground and service buildings. In addition, the County Board has appropriated $75,000 for an addition to the near-by Lane School. While veterans with children are assigned to prefabricated housing if possible, there isn't enough of this so there will be children at the camp. By careful planning, the authorities have made the development as comfortable as possible and at the same time have tried to eliminate objections to the camp by neighboring taxpayers. Dogs and other animals will not be allowed nor can veterans engage in any business on the site.

The 45-acre camp will be horseshoe shaped around an eight-acre wooded site which will be used as a park and playground for the tenants. Usual playground equipment will be available. There will be six service buildings so spaced that none of the 500 to 600 trailers will be more than a block from one. Each trailer will have from 1200 to 1500 square feet around it and wooden sidewalks will connect trailers to the concrete walks. Each veteran will be responsible for cutting the grass in his area and shovelling his wooden sidewalk. Lawn mowers and shovels can be borrowed from the attendant. Waste water, ice box drain and night pails must be emptied in the service buildings and must not be allowed to overflow. In winter calcium chloride is recommended to prevent freezing. Only fuel oil and garbage cans will be permitted around or under the trailer and these must be kept at the rear. The main street and sidewalks will be plowed by the county.

A storage space is provided in the service building for baby buggies and coaster wagons but tenants are advised that space is limited. The county will not be responsible for loss or damage to any tenant's equipment. The county also reserves the right to sell abandoned equipment after one month. If the proceeds are not needed for back rent or damage, they will be given to the tenant, if claimed, or will go into the general fund.

The cost of the project, exclusive of the trailers will be about $900,000. There will be 3 miles of 20 to 24-ft wide macadam roads, 3 miles of concrete sidewalks, 6 miles of street lighting, 2 miles of water pipes and enough fire plugs for fire protection. Three 200 to 250-ft. wells will be connected to a central pumping station for pumping into the water mains. The sum of $50,000 has been allotted for the construction of an administration building. All buildings are built with the idea of a future use after the need for the camp has passed.

In addition to fire hydrants, 40-gallon fire extinguishers will be available so small fires can be put out by camp personnel or tenants. In addition, each trailer is equipped with a fire extinguisher. Larger fires will be handled by the town of Greenfield fire department.

Two of the service buildings will be of the solar type so they can use the sun's heat in winter and eliminate it in summer. They are to be built of concrete blocks, and have toilets, sinks, laundry facilities and incinerators. The solar type buildings are large enough for drying clothes or use as recreation rooms. Other smaller buildings will use mechanical dryers. Bendix washers will rent for ten cents a half-hour which is lower than commercial firms charge.

Monthly rental charges for the trailers are based on 1% of the cost of the trailer plus $10 a month service charge. This includes electricity and water. After September first, the rent will be increased $8 a month and bottled gas for cooking and fuel oil for space heating will be included. A 15-ampere breaker is installed and tenants are prohibited from using electric hot plates or other types of electric cooking or heating appliances. With the increase, the rentals will range from $34 to $44 a month.

All trailers will be two-door for fire safety. The single door ones now owned will either be disposed of, traded in or remodeled with an extra door.

Each tenant is furnished with a booklet giving rules and instructions for operating equipment. Trailers are furnished with gas stoves, for bottle gas, space heaters, ice boxes, beds, studio couches, fire extinguishers and tables. Repairing will be done by the county on service requests. As the county has about 1600

(Continued on page 41)

Sewage Treatment:

Central Treatment vs. Several Small Plants

THE Allegheny County Sanitary Authority has reported a proposed plan for the collection and treatment of the municipal sewage and industrial wastes of the county, estimated at 250 mgd in the year 2,000. An important feature of their study of the problem was a comparison of the relative cost and advantages of multiple sewage treatment plants as compared to one central plant. The various projects considered were narrowed down to four. No. 1 comprises a single central sewage treatment plant serving the entire Authority service area with the exception of one small plant. No. 2 comprises three sewage treatment plants with corresponding interceptor sewer system and sewage pumping stations. Nos. 3 and 4 are similar to No. 2, but with 5 and 11 plants respectively. The total estimated costs, including interceptor sewers, treatment plant, pumping stations, land and right-of-way is $82,000,000 for No. 1, $77,095,000 for No. 2, $74,117,000 for No. 3, and $74,863,000 for No. 4. The total annual burdens of the four projects as of 1965 were estimated to be, respectively, $5,040,000, $5,014,000, $4,897,000 and $5,167,000.

In spite of greater costs of construction and annual burden, No. 1 was recommended on "sound engineering merit and other intangible values." A number of the reasons for recommending Project No. 1 are given by the Authority as follows:

1. The fewer the number of sewage treatment plants, the fewer will be the group objections to their location.

2. More efficient operation is possible with a large single treatment plant, as compared with that of small ones.

3. Industrial wastes can be handled to greater degree and advantage in a large central plant than in the smaller plants. In some cases the types and quantities of industrial wastes must be largely eliminated or else be required to be pre-treated before they can be accepted in the smaller plants. All industrial wastes examined by the Authority are acceptable for treatment in a large central plant excepting acid-iron wastes.

4. The problem of sludge disposal at the smaller plants is more difficult and costly because storage and dumping space is not readily available at every site. There is sufficient space at the proposed central plant location to provide for disposal of sludge incinerator ash deposits for a great many years.

5. Odorless operation can be realized with large treatment plants of proper design providing for covered structures and adequate ventilating equipment with more effective means of sludge disposal by incineration under greater technical control. Small plants cannot afford provisions for odorless operation in the same degree.

6. There is an obvious advantage to carrying all of the raw sewage down stream from Pittsburgh for treatment at a central plant, thus affecting the removal of collected sewage from the streams during dry weather from the upper end of the sewage service area down to the point where the treated effluent is discharged from the central plant, and thereby making the river water above the plant site of better quality. With multiple plant installations, as much as 65% of the total organic pollution might be returned to the streams in the effluents from the individual plants in meeting the orders of the Sanitary Water Board, in contrast to the complete diversion of the sewage pollution from the streams of the County above the proposed location of the central treatment plant on the Ohio River.

7. A large treatment plant can assimilate momentary shock loads of industrial wastes, in contrast to a small plant, the operation of which can be completely paralyzed by a similar shock.

8. A large treatment plant can assimilate high peak flows of sewage with greater ease and efficiency than is possible in a small plant.

9. A large treatment plant presents greater flexibility of operation because of large individual units and capacities for meeting emergencies due to breakdowns, operating difficulties, or shock loads.

10. More efficient supervision is available in large treatment plants by virtue of more efficient personnel, attracted by higher salaries of technical staff which a large plant can afford.

11. The peak flows causing variation in results of treatment are less in large treatment plants because of the ironing-out effects of flow through long interceptors. Short interceptors leading to small plants reflect peak flows quickly and thus place a heavy burden on operations and requirements of design.

Charges for Sewerage Service

It is proposed to carry the annual burden by means of service charges, and the following schedule of rates per 1000 gals. per quarter was recommended:

First	0.10 mg.	@	18¢
Next	1.00 mg.	@	12¢
Next	2.25 mg.	@	9¢
Over	3.35 mg.	@	7¢

It is provided however, that no bill would be rendered for less than 50¢ per month. No discounts would be allowed at the start. Flat rate charges shall be equivalent to 85% of the present flat rate charge for water usage now in effect in the City of Pittsburgh.

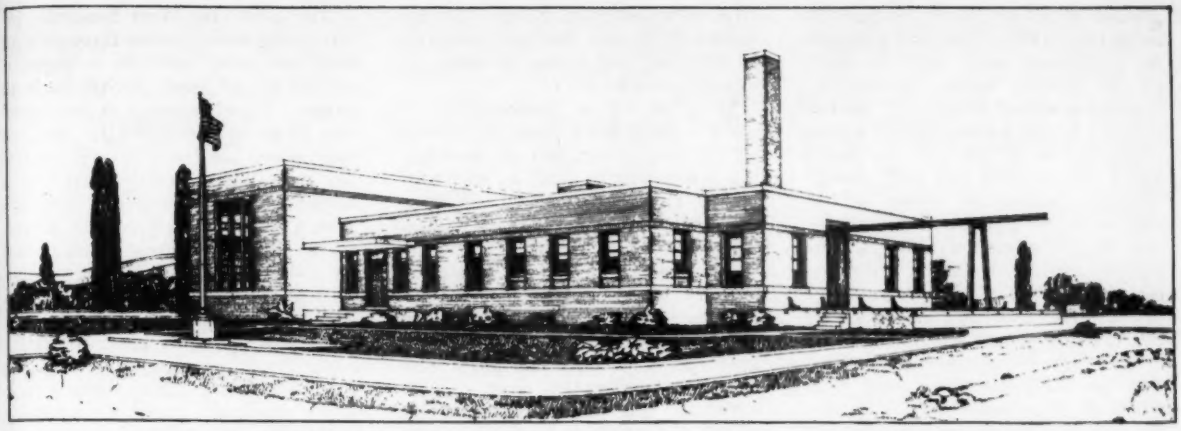
A special study has been made of the additional cost of treating excessive volumes of industrial wastes as measured in terms of total suspended solids, biochemical oxygen demand and chlorine demand in excess of normal requirements, based on primary treatment. An extra charge will be made to commercial and industrial establishments when the suspended solids are greater than 275 parts per million and the biochemical oxygen demand greater than 300 parts per million. The proposed formula on which the excess charge will be based is as follows:

$$F = 1 + R\left[\frac{0.75\,(S_1 - S_n)}{S_n} + \frac{0.25\,B_1 - B_n}{B_n}\right]$$

Where,

F = Factor to be applied to basic rate.
R = Ratio of *Quality* Cost to Total Annual Cost = 0.15

(Continued on page 51)

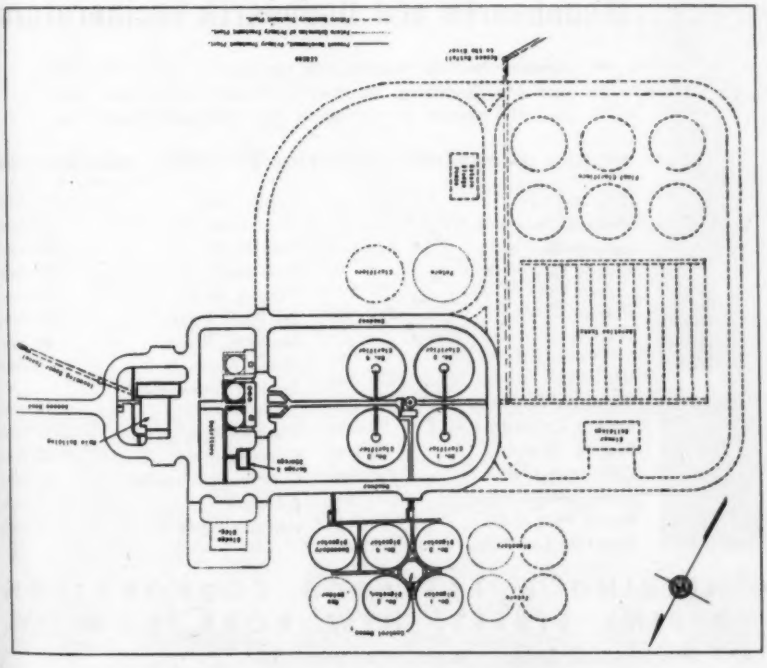


Artist's drawing of the main building of Nashville's proposed sewage treatment plant.

Sewerage Plans for the Nashville Urban Area

A PLAN for disposing of the sewage of Nashville, Tenn., is outlined in an unusually comprehensive report prepared by Hart, Freeland & Roberts of Nashville and Polk, Powell & Hendon of Birmingham, Ala. Havens & Emerson acted as consultants on the plans for sewage treatment, and Silas H. Woodward on the designing and constructing of the tunnel which is an important feature of the plan. The report, published as a book of 130 pages and 20 illustrations, is so written as to be readily understandable by any citizen of average intelligence, and also furnishes the engineering data to support their statements and judgments. The following gives, in condensed form, the essential features of the report.

Nashville is built on both sides of the Cumberland river, and all of the sewage, industrial wastes and storm water from that city and the surrounding territory reaches the river, either directly through 26 combined sewers or by way of four creeks. The resulting pollution of the river is becoming intolerable, even though 48.6% of the citizens are not served by the sewers but rely on pit privies and septic tanks. This insufficiency of sewerage facilities in a city of this size calls for immediate remedy, but if the necessary sewers are built and utilized by all of the population of a few years hence, the pollution of the river would be several times what it now is unless the sewage be treated. The problem was to determine the amount of pollution to be expected, the capacity of the river for self-purification, and the amount of purification of the sewage therefore required.



General layout of proposed Nashville plant.

Design Bases

In 1940, the total population of the urban area was 226,800, of which 36% lived outside the city limits; and it is estimated that in 1985 the total population of the area will be 335,000; of which 125,000 will live outside the present city limits, but their sewage must be taken care of, whether or not the limits meantime are extended to embrace them. At present, industries located in this area produce liquid wastes equivalent to a population of 192,000 people on the basis of the B.O.D.

In preparing the plans, the intercepting sewers, buildings and under-

ground structures were designed to serve until 1985; tanks and mechanical equipment until 1965. A study of the present water consumption, industrial wastes and sewer infiltration led to the assumption of a total average flow of 160 gpd per capita and a maximum of 400 gpd; this including commercial wastes at the rate of 30,000 gpd per acre average, and 90,000 maximum; 200 gpd per acre of infiltration; and a storm water flow of 2.6 times the average dry-weather flow (all in excess of this to overflow into the river).

The average monthly flow of the river at Nashville has varied from 8,000 cfs in summer and fall to 30,000 cfs in winter and spring; but the minimum daily flow may be 350 cfs, and has been less than 1,000 cfs for 43 consecutive days. However, plans of the Army engineers contemplate a development of the river to aid navigation and flood control that will limit the minimum to 8,000 cfs. When these plans have been effectuated the need for sewage treatment beyond the primary stage will be obviated. Therefore it is proposed to provide for primary treatment only, with provision for sterilizing the effluent because of the use of the river for the water supply of Clarksville, 60 miles down stream. Also the design facilitates the later adoption of chemical coagulation or other additional treatment.

It is of course impracticable to place a purification plant at the outlet of every sewer, and an intercepting sewer will be built on each side of the river, at sufficient depth to take the dry-weather flow of all existing sewers, and also of all future sewers (which would probably be sanitary sewers only). In considering whether to construct a treatment plant at the end of each of these interceptors, or only one plant with a syphon under the river, it was estimated that the construction cost of the two methods would be about the same, but the single plant would cost less to operate, operating conditions would be more simplified and operating control easier, and this therefore was recommended.

Intercepting Sewers

The designing of one of the intercepting sewers known as the East Nashville presented no special difficulties. It is 19,548 ft. long, with sizes ranging from 24″ to 54″. The river crossing syphon will consist of two lines of pipe 24″ and 30″ respectively, laid in the river bottom.

The other, the West Nashville intercepting sewer, passes through high land and rocky bluffs for a length of 44,138 ft., of which 39,900 ft. is in tunnel. The alternative to the tunnel was to pump over the hills; but not only would the latter involve operating costs, but it was learned that a tunnel would be cheaper to construct than a sewer in open cuts in narrow streets in the business district, and the latter would greatly inconvenience the citizens for several months. The State Division of Geology advised that the geological formation along the proposed route is favorable for tunnel construction, being a relatively insoluble limestone probably containing no significant crevices to permit water infiltration. About 75% of the tunnel is 7′6″ x 8′4″ and the other 25% is 4′6″ x 5′0″.

The length of this interceptor and the grades of the sewers intercepted made pumping necessary, the only question being whether this should be confined to one location or divided among several plants along the interceptor. The latter would permit decreasing the average depth of the tunnel, but this would have little effect on construction cost, while multiple pumping plants would add considerably to the cost of both construction and operation. Therefore

only one pumping plant is provided, located at the treatment plant, where the total lift does not exceed 80 ft.

The Treatment Plant

The treatment plant will include sedimentation tanks giving a detention period of 2 hr. for the design average flow of 40 mgd, and ½ hr. for maximum flow. Sludge handling and disposal facilities are provided for the 1965 population with a population equivalent of 50,000 for industrial wastes. In addition to the pumping station and sedimentation tanks, there will be screens, grit removal tanks, sewage meters, and sludge digestion tanks providing a 50-day digestion period. After pumping, the entire plant will operate by gravity.

Consideration was given to the preparation of the sludge for fertilizer, but the financial balance and mechanical difficulties presented arguments against this, and the use of lagoons or sludge ponds was decided upon.

It was estimated that the digestion tanks will produce an average of 260,000 cu. ft. of gas per day, which would generate about 700 hp. The combined installed capacity of electric motors for treatment plant and pumping station is about 3,200 hp, leaving 2500 hp to be generated by other means, or purchased as electric power from the Tennessee Valley Authority. The rates of the latter are very low, and the most economical arrangement appeared to be the purchase of all power; using about half the sludge gas for heating the sludge digestion tanks and plant buildings, and wasting the remainder.

For financing the project, it is recommended that the city activate a sanitary sewerage district under a recent statute which permits a municipality to finance, construct and operate public works for the benefit of citizens residing within 20 miles of its boundaries. The necessary funds would be raised by means of service charges based on amount of water consumed, estimated to be $0.50 per month for domestic users and $3.50 for commercial and industrial users.

Trailer Camp

(Continued from page 37)

units, people are warned that service may not be as prompt as desirable. Each tenant is required to deposit ten dollars with the county to pay for any loss or damage not caused by ordinary wear and tear.

While there will be from 500 to 600 trailers, the estimated population for the camp will be about 1800. Some trailers have 6 or 7 people in them. A parking lot which will accommodate 300-400 cars will be on the outskirts. No cars will be allowed at the trailers because congestion would be a fire hazard. No stores have been included but several new stores are being built along Greenfield avenue by private owners.

Transportation will not be a problem as residents can use either a bus line or the Rapid Transit. Telephones are permitted but tenants have to pay for them. Emergency calls can be made to the administration building. Mail will be called for at the administration building.

There are no sewer or water connections to any of the trailers. All water must be carried in from the taps provided in the service buildings, and all sewage must be emptied in the designated facilities. Little trouble has been experienced with tenants emptying pails on the ground.

At present, it has not been determined how much help will be needed but 24-hour service will be maintained, the night men watching for fires and doing miscellaneous work in the service buildings. Police protection will be obtained from the county sheriff.

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- Building Ditches
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City-County PUBLIC WORKS Engineering Data

County Highway Personnel Turnover 60%

In a questionnaire sent to County Engineers during the summer of 1948, the question was asked: "What percentage of your engineering employees have joined your staff since the end of the war?" To this question, 509 replies were received. In 197 counties there have been no increases or changes. Many of these appear to be counties which maintain a one-man staff. In 312 counties, there have been changes. Replies from 240 of these were expressed in percentages and 72 in number of personnel.

In terms of percentages, 20 of the 240 counties reported turnover or additions at less than 20%; 35 reported changes of 20% to 40%; 55 stated that the changes were more than 40% but less than 60%; and in 34 the changes ranged from 60% to 80%. In 96 counties, the changes exceeded 80% and in 80 of these counties the turnover amounted to 100%. In number of personnel, 37 reported adding 1 engineer; 19 added 2; 7 added 3; 5 added 4 men; 3 added 5 men; and 1 added 7.

Thus in the short period from the end of the war to early in 1948, somewhat over 60% of the counties appear to have accomplished major changes in engineering personnel.

Fly Control at Newark's Refuse Disposal Areas

JOHN H. AUSTIN
Prin. Ass't Engr., Department of Parks and Public Property, Newark, N. J.

In 1947, the Bureau of Sanitation, Department of Parks and Public Improvements of Newark, in cooperation with the Health Department of the Department of Public Affairs, conducted an experiment in the control of flies at the City Disposal area. Such good results were obtained that the effort was repeated in 1948 and will be continued as long as open dumps are used for the disposal of garbage.

The Bureau of Sanitation contracted with the Accurate Tool Co. of Newark to spray 100 acres of the disposal area with a DDT concentrate containing 25% DDT (technical grade), known as Accurate Standard No. 2 Insecticide. The entire area was first sprayed by specially designed equipment which was regulated to deposit approximately 1 pound of DDT per acre. The reduction in the fly population was very evident and was estimated to be at least 80%.

In order to maintain fly control, newly dumped areas were sprayed twice weekly with the same solution, using a large spray machine loaned to the Bureau by the Shade Tree Bureau. In addition to the area

spraying, approximately 80 City owned trucks and 8 privately owned trucks used for hauling garbage and street sweepings were sprayed weekly during the fly season.

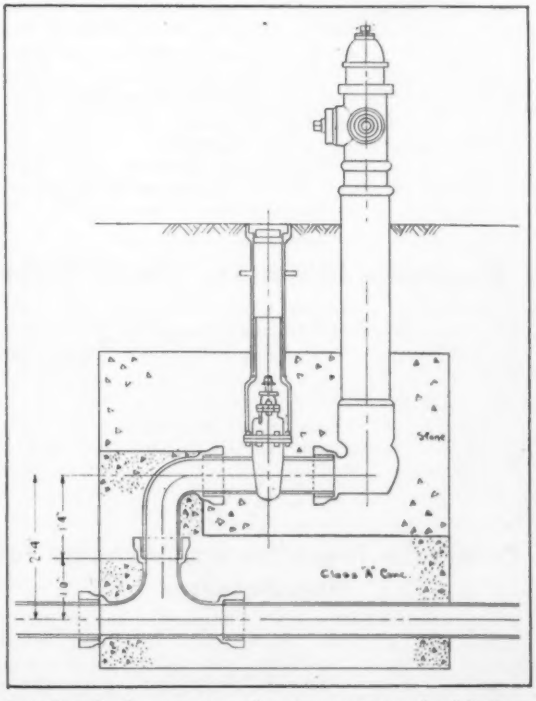
"Team Tamper" Speeds Compaction

For compacting fills on an expressway job, six backfill tampers were mounted on a frame so they could be operated simultaneously by a 3-man crew. The tampers were 66-T Thor; a manifold fed air to all six units from a Jaeger 125-ft. compressor; the unit was suspended from a side boom on a Caterpillar tractor. Time and labor savings were reported at about 50%. The device was engineered by the Killian-House Construction Co., San Antonio, Tex., and was reported in the house organ, *The Thor Scoreboard*, of the Independent Pneumatic Tool Co.

Installing Hydrant on Top of Main

A special fitting has been developed by the Lucas Co., Ohio, Water Department, in order to save right-of-way space in the streets. Since most city streets in Lucas Co. are either 50 ft. or 60 ft. wide, there is hardly sufficient space for pavement, sidewalks, storm sewer, sanitary sewer, water pipe and utilities. Standard hydrant installation, using a T, places the hydrant 6 or 7 ft. from the water line. To save space, a special fire hydrant T was developed so that the hydrant could be placed directly over the top of the water main supplying it. In most of the streets, the water main was close to the storm sewer, and it required special fittings to go over or under the storm sewer.

This new arrangement requires only 18" right-of-way for the water department, leaving additional needed street space for other utilities. The hydrant



Installing hydrant on top of main, using standard fittings.

definitely indicates the location of the main. This type of construction has been used for several years and has been satisfactory in every way.

This new idea was reported by Raymond E. Hall, sanitary engineer of Lucas County, and was published in *Cast Iron Pipe News*, to whom we are also indebted for the illustration herewith showing how the same general results can be obtained by the use of standard fittings.

Bid Prices on Sewers and Pumping Stations

Bids for the construction of sewers and pumping stations, for the Omaha flood control project were received Oct. 22. Two bids were received. Below are given, in order, the item, the amount, the government estimate, the low bid and the second bid.

Structural excavation, 6,020 cy., $1.62, $1.85, $5.00. Backfill, 4,105 cy., $1.37, $2.10, $4.80. Concrete, 1,276 cy., $36.65, $34.50, $108.00. Reinforced concrete pipe: 48", 0 to 12' depth, 576 ft., $37.41, $43.00, $50.50; 42", 10.1' to 12' depth, 252 ft., $34.01, $40.00, $40.00; 30", 0 to 8', 110 ft., $22.68, $20.60, $25.00; 24", 0 to 6', 220 ft., $18.08, $13.10, $21.00; 24", 6.1' to 8', 124 ft., $20.18, $15.70, $24.00; 24", 8.1' to 10', 178 ft., $21.26, $20.20, $28.00. Manhole, standard, 5-ft. diameter, 6, $406.74, $525.00; $594.00.

Accident Record—Freeway vs. 3-Lane

A 3-lane highway, Colton to Ontario, California, carrying a heavy-mixed passenger and truck traffic had a bad accident record. In the post-war construction program, the road was rebuilt as a limited freeway; however, two short temporary connections remained.

Comparisons on 15.2 miles of freeway, exclusive of the temporary connections, and on a similar mileage of the old road, show a reduction in accidents of 64% —from 146 to 53—for an equal period of time before and after opening of the freeway. Daylight accidents decreased 83% and after-dark accidents 48%. There was a reduction in fatal accidents and accidents involving pedestrians were eliminated.

These data are from an article by B. A. Switzer, Associate Highway Traffic Engineer, in *California Highways* and *Public Works*.

Workable Miniature Water Filter

A working miniature of the Little Rock, Ark., water filtration plant has been constructed. Major units of the plant were built at local machine and other shops, while the smaller part were made at the filter plant. The total cost of the miniature plant was slightly under $60. It was designed by W. A. Maybrook, Superintendent of Filtration. L. A. Jackson is Manager-Engineer. This model plant has been very effective in public relations work.

Colorado Town Cooks Garbage for Hog-Feeding

The town of Cortez, Colo., employs a man to collect trash and garbage. The garbage is cooked before feeding to hogs. This is one of the relatively few communities, so far as we know, that takes the precaution of cooking the garbage.

High Maintenance Costs!

When you use lumber and posts treated with Pentachlorophenol, you are taking a big step toward reducing high maintenance costs. That's because wood treated with Pentachlorophenol is decay and termite-proof.

Pentachlorophenol lasts longer . . . requires less maintenance. Your maintenance crews like to work with "Penta"-treated wood. It's clean and easy to handle. And, in addition, wood treated with Pentachlorophenol is paintable when the proper solvent is used.

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When you need special information—consult the READERS' SERVICE DEPT. on pages 77-80

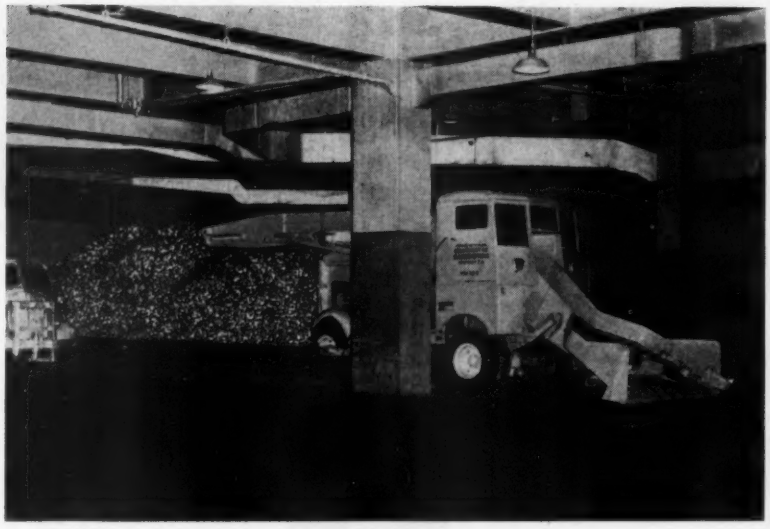
Rock Salt Storage in New York

WILLIAM J. POWELL
Commissioner, Department of Sanitation, New York, New York

WHEN you're faced with the problem of storing sufficient rock salt to use on 2400 miles of city streets for snow and ice removal, you search carefully for storage facilities and, of necessity, you develop a smooth-working storage operation.

Here in New York we have as yet no structures built specifically for rock salt storage; we depend upon unused space in garages, incinerators and other buildings strategically located throughout the five boroughs. To make sure that we have an adequate supply on hand for all storm contingencies we begin taking deliveries in October, filling our storage spots early and keeping them filled throughout the winter. Without such early delivery and adequate storage we could not sufficiently carry out our snow removal program.

Along our routes we have 54 separate storage points, all of them indoor locations—43 garages, 7 incinerators, 1 waterfront disposal station, a large area in the Bronx Terminal Market, and 2 bins under the West Side Highway at 158th Street. Some of this space we use only because at present we have nothing better; with careful advance planning, however, we have managed to make the storage program work satisfactorily.



Salt storage in one of New York City's garages.

Planning Begins

Our planning for winter begins during the summer, when we ask our district superintendents to survey their areas carefully and report to us all possible storage locations, the storage capacity of each one, the amount on hand from the previous winter in each district, and the approximate requirements for the winter ahead. In selecting buildings to serve as possible storage depots, we try to get spots that are centrally located in each district. When we have made our selections we prepare a storage map, listing all this information, so that we know at a glance the relationship of the depot to the rest of the district, the amount of rock salt on hand, and similar data.

The salt is delivered in box cars to railroad sidings in the five boroughs. We unload through chutes into 7 and 10-ton capacity dump trucks, which haul it to the various storage depots, assigning two trucks and five men to each car; generally they finish the job in 6 hours.

To load rock salt on spreaders during winter storms we use obsolete snow loading machines, except for a few depots where storage is on the upper deck of an obsolete incinerator. Here we have broken holes in the floor, and, using small plows, we push the rock salt to the holes and into trucks waiting below.

Getting Ready for Storms

From the Weather Bureau and the airports we receive detailed storm reports, and, when we get word that a storm is coming we notify our 60 field stations by teletype, sending out an order directing the garage foremen to make sure that all our equipment is ready for action. About 10,000 men and several thousand pieces of equipment are involved in this preparatory operation.

As soon as it begins to snow, we dispatch rotary snow brooms to elevated express highways and bridges to sweep the snow aside. When the fall reaches a one-inch depth the rock salt spreaders go out, covering bus routes and main thoroughfares first, then to main cross-town and less important streets, and finally residential areas, putting straight rock salt on all of them. For anything up to a four-inch fall and for freezing rains we have found that this procedure is fast and efficient, and ordinarily we do not need to plow. When we do plow heavier falls, we spread rock salt first to keep the snow from bonding, so that the plows can go right down to the pavement.

To keep track of the progress of a storm we have established a weather station at each field headquarters. These stations send in reports every half hour on the temperature and depth of fall, so that we can plot its movement and can change our strategy, if necessary, as it continues. By storing adequate supplies of rock salt early in the fall at strategic locations, and by organizing our snow forces efficiently in these ways we are able to give the city safe, snow-free streets throughout the winter.

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A LIGHT WEIGHT, COMPLETE, COMPACT SEWER CLEANING UNIT, always ready to go on a minute's notice. No loading or unloading equipment on and off truck. Carries full Flexible rodding outfit, pipe guide and power drive, and also other needed equipment such as hose, picks and shovels, bucket, rope and red flags.

FREES TRUCK

Take 2 men and trailer to the work and leave them. They have everything they need on the trailer. EZY ROD and REEL STAND PERMANENTLY MOUNTED on trailer, and rods are reeled from trailer.

LARGE LOCKED TOOL BOX keeps tools in place and avoids loss through misplacement.

TRAILS NICELY and does not slow down speed going to or coming from work.

SPECIFICATIONS:

Two wheel all-steel trailer with adjustable tongue, strong frame and ample reinforcing to last a lifetime; heavy cantilever springs, 6.00 x 16" pneumatic tires, roller bearing wheels; mounting for EZY Reel and stand, large tool box with lock clasp, open box for bulky equipment, carrier underneath for 1½ pipe guide, with removable caster wheel for pushing about on the job.

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STEEL SEWER ROD

The Important Tool Announcement of the Year. FLEXIBLE'S new "Flexicrome" Steel Sewer Rod is the result of four solid years of research by one of America's largest steel mills—plus intensive experimental work in Flexible's own factory as well as in the field. It's the last-word in tool steel development, aimed at highly specialized jobs. Made exclusively for Flexible, "Flexicrome" has proven its ability to outlast and outwork any other metal available today by at least three times.

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Modernized Sewer Maintenance

D. H. HURST
City Engineer, Tifton, Ga.

WHEN I was employed by the City of Tifton, in July, 1939, the city was in the midst of a construction program to extend the existing sewer system and construct a new sewage disposal plant. At that time the city had no maps of the existing sewer system, but at present we have accurate sewer maps and "Y" records of all construction during my nine years as city engineer. Our permanent records also now include all information we have been able to obtain on the original system.

In surveying the old system for permanent maps and records we found that a lot of the sanitary lines had storm sewer connections which accounted for most of the water and sand we had previously attributed to infiltration. This problem was corrected, in part by laying additional storm and sanitary sewers to separate storm and drainage water from the sanitary flow, thereby keeping storm water from entering the sewage plant and reducing treatment costs to a more normal level. In dollars and cents the saving to Tifton amounted to better than $600 a year in pumping costs alone. By diverting the storm water we, of course, eliminated a lot of the sand which previously had to be removed manually at regular intervals. This created an additional saving for the city, not in labor costs alone, but in wear and tear on the mechanical equipment.

Problems of a Growing City

In 1939 the population of Tifton was approximately 3000. As with a number of cities and towns we have since more than doubled our population; and we have increased our city area by one-third. In 1948 the Chamber of Commerce records show our population to be between 8000 and 9000. In some cases we have found the present sewer lines to be large enough to handle the resulting increase in flow, but in other sections of our city the additional connections overtaxed the capacity of the lines. We also found that accumulated sand deposits and roots, greatly decreased the capacity of the sewers.

Portable motor, right, powers pulling winch at lower manhole. Motor is also used for turning rods.

In 1939 our sewer maintenance consisted of a pass and a prayer. This is the circumstance in which most city engineers find themselves when the city does not own modern sewer maintenance equipment. Our sewer maintenance costs were entirely out of line because of the digups that were necessary to eliminate serious root conditions. We decided to lick this problem by systematically cleaning our six and eight-inch lines. We investigated available equipment and after a successful demonstration by the Flexible Sewer-Rod Equipment Co., we purchased a standard city set. This basic equipment enabled us to start our maintenance program and to handle all emergency stoppage at a minimum labor cost. At this point our stage of pass-and-prayer was eliminated and we felt we needed to develop our progressive running attack. This was started by carrying monies in our budget for additional labor, and for purchase equipment as needed.

We all remember conditions during the war. Labor was scarce and necessary equipment was at a premium. Frankly, there were times when we were afraid that we would have to call on the city manager to help out. During this period, however, we were able to catch up with all stoppages, make all necessary connections, and keep some semblance of order. We know that our cleaning equipment saved us a lot of time and labor during the emergency.

More Sewer Cleaning Equipment

To the basic equipment mentioned above we added sand cups, root cutting augers, and a power drive for turning the rods. This enabled us to do a better job on our ten and twelve-inch lines. However, one problem always brings on another; as we progressed on our systematic cleaning we found the increased volume of sewage flowing through the new lines occasionally caused our trunk lines to back up and overflow. This situation was aggravated by several conditions common to all municipalities: (1) Infiltration, not yet completely eliminated; (2) additional connections on existing lines; (3) new industries; and (4) extension of lines to service new areas.

A checkup disclosed a serious condition in our 15, 18, and 24-inch outfalls. In some cases the capacity of our outfalls was decreased by 50%

Rodding section of 15" sewer to pick up cable.

due to sand deposits and roots. We have now cleaned our outfalls and eliminated these bad spots with the use of additional "Flexible" equipment.

In one specific instance we cleaned 3000 feet of 15 and 18-inch line at a total cost to the city of 12 cents per foot. We had seriously considered cleaning this 3000 feet by contract and the lowest estimate offered the city was $1 per foot. This work was done with city labor and the cost, including the purchase of the needed "Flexible" equipment, amounted to less than $2000. This showed a saving to the city of slightly over $1000 and the city now has the equipment for future cleaning when necessary.

The standard sewer cleaning crew consists of 3 men, and the equipment, in addition to the sewer cleaning devices, are a truck and a 4" diaphragm pump which is used to pump the sand out of the manhole. The sand is loaded into the truck by hand and is disposed of at the sewage plant.

This period from 1939 to 1948 as City Engineer of Tifton has been the most interesting in my experience. The fact that the Engineering Dept. has been able to keep pace with the fast-moving development of Tifton, the large increase in population, new homes and industries, is largely attributable to the cooperation of its citizens and the city officials.

Sewage Treatment

(Continued from page 38)

S_1 = Suspended Solids of Sewage from particular industry in p.p.m.
S_a = Average Suspended Solids of all sewage = 275 p.p.m.
B_1 = B.O.D. of sewage from particular industry in p.p.m.
B_a = Average B.O.D. of all sewage = 300 p.p.m.

The increase in cost on this basis is predicated on the actual treatment

costs of the excessive volumes, suspended solids and biochemical oxygen demand. The charge is nominal. As an example, on the basis of a suspended solids content of 500 parts per million and a biochemical oxygen demand of 500 parts per million, the additional charge would be 11.7% of the total bill.

An additional charge will also be made for treatment of wastes possessing an excessive chlorine demand. Chlorination of the effluent of the sewage treatment plant will be a requirement of the Sanitary Water Board. The chlorine demand of the central plant sewage cannot be determined until the plant is in operation and therefore only the rate formula can be given now, as follows:

$$R_e = FP_e (C_i - C_a)$$

Where,

R_e = Surcharge Rate for Chlorine Demand in cents per thousand gallons
C_i = Chlorine Demand of wastes from particular industry in p.p.m.
C_a = Average Chlorine Demand of all sewage in p.p.m.
F = Factor for converting p.p.m. to pounds per thousand gallons = .00835
P_e = Contract price of chlorine in cents per pound

This charge likewise is nominal.

Construction of the Clark Hill Dam

The Clark Hill Dam is the first major project in the development of the Savannah River. It is a combination earth fill and concrete dam, with a maximum reservoir depth of 160 ft. The area of the reservoir, when full, will be 78,500 acres, and the water will back up 37 miles along the Savannah, 29 miles on the Little River in Georgia and 17 miles in South Carolina. Water from the reservoir will be used to regulate navigation and for flood control and power.

An IHC TD-24 diesel tractor is part of the rather complete equipment being used by the Hardaway Contracting Co. on construction of the first stage cofferdam and the foundation excavation for the concrete portion of the dam. This contract includes 300,000 cu. yds. of earth and 70,000 cu. yds. of rock excavation, and construction of a cellular sheet steel cofferdam. The cofferdam consists of 33 cells, 47 feet, 9 inches in diameter, with connecting diaphragms and earth fill dikes at each end. The total length of the steel sheet pile section is 1,660 linear feet. The height of the cells vary from 40 to 50 feet, depending on the elevation of the bed rock. All piling was driven through overburden varying from two feet to twenty feet in depth to bed rock. The earth dikes have sheet steel pile cutoffs to bed rock.

The contractor used structural steel templates for setting the piles in the cells. Operations were started simultaneously from the upstream and downstream ends of the cofferdam. A 2-cubic yard crawler crane was used to handle the template and the piling. After the piles were racked they were driven with pile drivers using compressed air at 100 p.s.i. instead of steam for power. The cells were filled with sand and gravel pumped from the river channel with a job fabricated 6-inch "sand sucker." The average progress on setting the cells was two cells per week. When the cofferdam was completed, the enclosed area was pumped dry with two 6-inch pumps and one 8-inch pump. A very tight seal was obtained between the cofferdam and bed rock and one 6-inch pump working inter-

mittently was sufficient to handle all drainage into and seepage through the cofferdam.

Earth excavation was accomplished with scrapers in the dry sections and dragline and end-dump trucks in the wetter sections. The earth, with the exception of some 20,000 cubic yards which was placed in the cofferdam dikes, was spoiled or stockpiled in areas upstream from the dam at an average haul distance of 1200 feet. The rock was drilled and blasted using conventional wagon drill and blasting methods. The excavated rock was placed on the upstream face of the west embankment to form an 8-foot thick quarry-run riprap blanket.

Tractors were used freely and advantageously to assist the operation of the scraper pans, to spread the earth in the spoil areas, to assist with the loading of the blasted rock, and to spread the rock in the riprap blanket on the west embankment. A 2-cubic yard and a 1-cubic yard shovel was used to load the blasted rock into 6-cubic yard and 8-cubic yard end dump trucks. The rock hauled to the riprap blanket was dumped on the top of the blanket adjacent to the earth fill and a tractor was used to spread the material. The tractor was operated very skillfully to place the finer rock next to the embankment fill and the larger rock at the exposed face.

The Clark Hill Dam is being constructed under the direction of Colonel Paschal N. Strong, District Engineer, Savannah District. C. F. Trainor is the Technical Assistant, Savannah District; Grady L. Bain is the Resident Engineer at the site: and A. C. Marane is Construction Engineer and Assistant Resident Engineer. T. W. Goodson is Superintendent at the site for the Hardaway Contracting Company.

Cleveland Reservoir and Filter

(Continued from page 29)

just prior to the placing of the concrete.

One of the problems to be solved by the contractor was the preparation of the vertical shale facing to receive the wall concrete. It was necessary that this facing be free of all loose or disintegrated shale at the time the reservoir wall was to be constructed. Some experience during the WPA days indicated that if vertical shale was trimmed with air hammers it weathered and disintegrated rapidly. The contractor solved this problem very ingeniously by the use of a heavy trenching machine. In most places around the reservoir there was sufficient shale to be removed so that a trench could be dug in it in such a location that the outer face of the trench became the shale face against which the wall concrete was to be placed. The remaining shale between the inner face of the trench and the area previously excavated was then removed with shovels. It was found that the vertical shale face as cut with the trenching machine showed little or no disintegration for as long as two months after being cut.

Two classes of concrete were used in construction, viz: Class A and Class B. Class A concrete was for the lighter, more costly work, such as columns, roof, effluent conduit and influent wall. Class B concrete was for the more massive work where form costs were less, such as footings, walls, floor, etc. Class A concrete required a coarse aggregate passing sieves from No. 4 to ¾", and Class B concrete, from No. 4 to 1½". Air Entraining Portland Cement, meeting A.S.T.M. Specifications C175-46 A.T., type 1A, was used in all con-

crete. The coarse aggregate consisted of crushed slag "composed of clean, sound, durable and well seasoned blast furnace slag, weighing compacted not less than seventy pounds per cubic foot, reasonably free from thin, elongated or glassy pieces." A minimum of 6 sacks of cement per cubic yard was required for both classes of concrete. A slump of not more than 5" was allowed for Class A concrete and not more than 3", for Class B concrete. With few exceptions the actual slumps were less than those required.

In general all construction materials were delivered by rail. The City has a switch track on the site and this track was extended by the contractor to meet his needs.

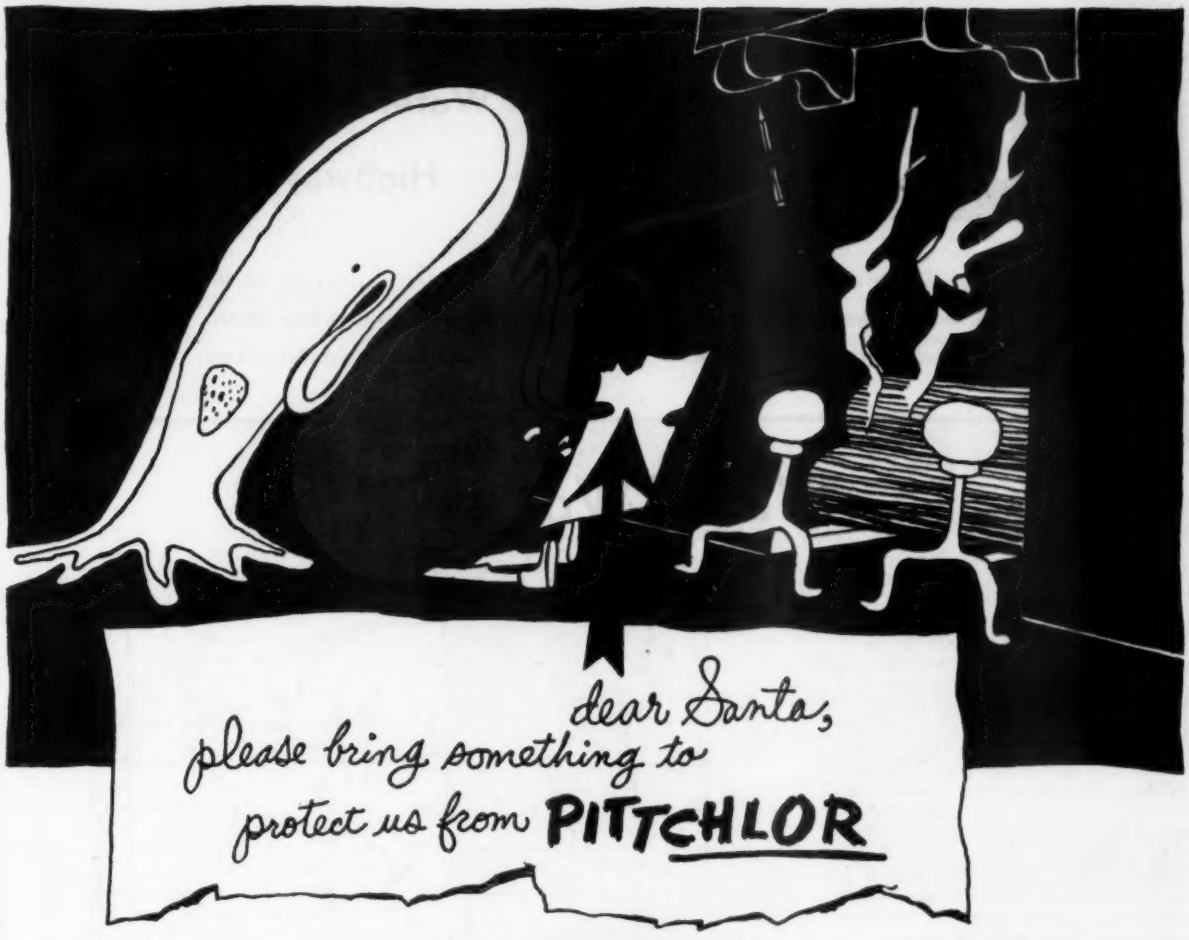
For concreting purposes the contractor used one bulk cement bin holding 200 barrels of cement and one aggremeter of 100 tons capacity. In addition, he had a storage house which held over 1200 sacks of cement, and large storage piles of fine and coarse aggregate. The bulk cement bin was loaded directly from cars and the aggremeter bin was filled by crane, from the stock piles. The contractor used two paving type mixers, one 27E and one 34E, and three Pumpcrete machines. On occasions, he used one or more ready-mix trucks which were loaded at the site. The concrete materials were hauled in dry batches to the mixers. For this purpose, the contractor employed four trucks each capable of hauling dry ingredients for four 1-yd. batches, or three 1 1/3-yd. batches.

In general, the concrete in the reservoir floor, column and wall footers was placed directly from the mixers. The Pumpcrete machines were used principally in placing concrete in the wall forms and on the roof. For the columns, concrete from the Pumpcrete equipment was pumped into a small hopper located on the roof forms and then hauled in buggies to the column forms.

Most of the forms, except those for the columns and upper part of the walls, were made of wood. For the walls and roof they were made in panels. The supports for the roof consisted of a wooden frame work built in sections and set on blocks on the reservoir floor. The roof panels (except at the drop panels) rested on this framework and were wedged in place at the proper elevation. The drop panels were held in place on jacks. To remove the roof forms to another location, the wedges under the roof panels were knocked out, the supporting framework lifted enough to remove the blocking and then lowered onto dollies. The entire framework and roof panels could be moved as required.

Organization

The contract was awarded to The Domenic Nero Construction Company for $1,331,355. The work is being done for the Division of Water and Heat, Department of Public Utilities, Cleveland, Ohio. Thomas A. Burke is Mayor; Emil J. Crown is Director of Public Utilities; and George W. Hamlin is Commissioner of Water and Heat. Plans and specifications were prepared by engineers of the Division of Water and Heat. Thomas R. Connor, Asst. Engineer of Design (Civil), was in charge of the design of the reservoir itself. Frank Cover, Engineer of Design (Mechanical), had charge of plans for the Pumping Station and other mechanical equipment. Arnold Turkel, Civil Engineer, was in charge of specifications. A. D. Rice, Sr. Asst. Civil Engineer, acted as Resident Engineer on construction; A. G. Levy, Engineer of Construction and Surveys, was in general charge of design and construction. Plans for the electrical layouts were prepared under the direction of Walter Skove, Electrical Engineer, Division of Light and Power.



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PUBLIC WORKS DIGESTS

Sewerage

Water Supply

Highways and Airports

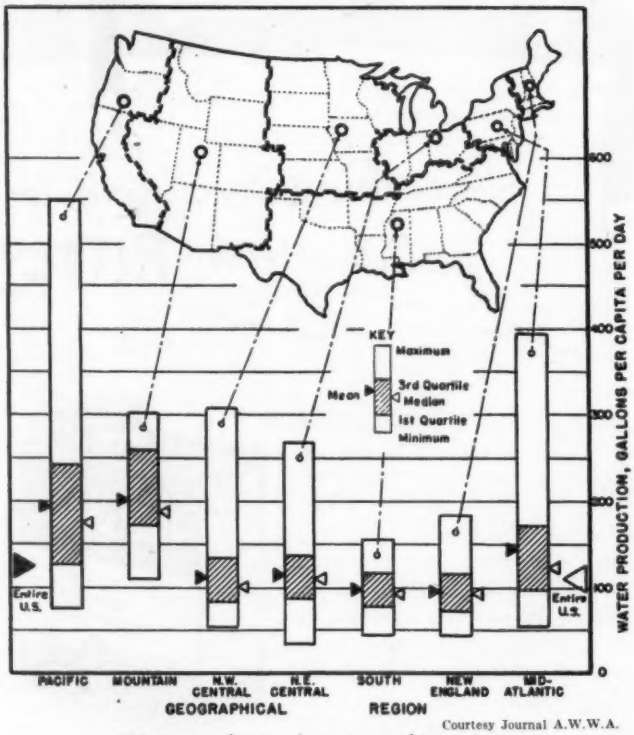
This section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

The Water Works Digest

An Analysis of Waterworks Data

The authors have analyzed a mass of data concerning 462 water properties for the year 1945 which had been collected and published by the A.W.W.A. in February 1948. Their analysis is divided into three parts: production and sales, physical data, and financial data. Production was studied by population groups, by geographical location, and in terms of rates. The rates are presented by tables, curves, and bar graphs. (An illustration of the last, showing production by geographic regions, is reproduced herewith.) Tables, diagrams and text occupy 32 pages. A few of the interesting facts brought out are: Privately owned supplies produce less water per capita than do public supplies but sell a higher percentage of it. The number of hydrants per mile of main varies from 1.0 to 19.21, with a mean of 6.75 and a mode of 4.34. (A "mode" is the most common, frequent or typical value. Values per mile vary from 0.14 to 33.33, with a mean of 13.08 and mode of 11.43. The miles of main per 1,000 population varies from 0.22 to 8.36, with a mean of 2.67; the mean decreasing quite regularly as the population increases, from 3.01 for cities of 10,000 to 25,000, to 1.69 to those of over 500,000.

G. J. Schroepfer, A. S. Johnson, H. F. Seidel and M. B. Al-Hakim—"A Statistical Analysis of Water Works Data for 1945"; *Journal, Am. W. W. Ass'n,* October.



Courtesy Journal A.W.W.A.

Water production by geographic regions.

Building a Large Steel Tank

In connection with supplying water to a large area near San Diego, Calif., the district has recently built a tank 100 ft. in diameter and 40.5 ft. high to the water line. Bids were asked for both steel and concrete construction, and the lowest bid for the latter was $99,200, while that for steel was $67,500 and was accepted. Some of the features of the design were the location inside the tank, instead of outside, of the 12" spillway pipe and 2 x 3 ft. spillway funnel; and the resting of the bottom on a 6" sand cushion, into which, after erection, was pumped SC-2 oil to fill all voids. Also screened vents 6" high were placed just below the top, occupying 50% of the circumference. (Plans for another tank provide for a concrete footing under the shell to carry its weight, but retaining the sand cushion; and a 1-ft. overhang of the roof to prevent run-off entering the vents). The steel was coated with Barrett's Coal Tar, and this was tested with a 10,000-volt spark for holidays, which were repainted. The underside of the roof was given two coats of Bitumastic odorless and tasteless "tank solution."

M. J. Shelton—"Constructing a 2,300,000-Gallon Steel Reservoir"; PUBLIC WORKS, November.

Adding Fluoride To Water Supplies

In all cases it is the fluoride ion which is added to water and not fluorine. Fluoride treatment of public water supplies is now a regular practice at Grand

Rapids and Midland, Mich., Newburgh, N. Y., Sheboygan and Madison, Wis., Ottawa, Kans., Evanston, Ill., Marshall, Tex., and Brantford, Ont. In most cases commercial sodium fluoride is used, but one plant uses hydrofluoric acid. The answer to the question: "Shall fluoride be added to public water supplies?" will be supplied in part by the results of controlled studies under way, in part by the results of any other known preventive methods or future discoveries, and in part by local considerations.

Harry A. Faber—"Shall Fluoride Be Added to Public Water Supplies?"; *Water and Sewage Works*, November.

The Value of Water Works Schools

The amount of knowledge obtained by a trainee in a short-course school depends on his personal interest, previous education, mental capacity for learning, encouragement received from employer and family, and the caliber of training offered. He will absorb a new enthusiasm for his work, increase his contacts with people and literature, add to his sources of data, develop a better understanding of his duties and responsibilities, and appreciate the position of state and local agencies with which water supply officials have contact. Short-course training programs were reported in 1947 by 39% of the states. More than 2400 persons attended them. Usually they were sponsored jointly by the state health department, a university, and the state water works association. Michigan University believes that systematic training can be effectively brought to the trainee on his own job only by means of an itinerant instructor who would teach an extension course at night and spend a part of the day at the plant with the student. Referring to such schools in New York State, Chas. R. Cox of the State Dept. of Health said that:

"Trainees attending these courses have been benefited in several ways: (1) they have received technical instruction to supplement available reading material; (2) they have been given the opportunity to ask questions and to clarify their understanding of various subjects; (3) they have received the stimulus of contact with other operators; (4) their general attitude toward their work has been improved by a greater breadth of understanding and appreciation of their duties and responsibilities; and (5) they have obtained a more comprehensive knowledge of the state agencies having contact with local water supply officials.

"It seems proper that the minimum training required for certificates or licenses should be conducted by official state agencies. More extended training —such as correspondence courses—in fields of water supply not of direct concern to state agencies might well be organized by associations of water works officials.

"Laws and codes giving an official stamp to training programs by state departments of health, are beneficial because: (1) questions of expense and attendance at schools during working periods are clarified; (2) the organization of training personnel on the staff of state agencies gives official recognition to training programs and qualifications associated with civil service status; (3) the whole program is dignified in the eyes of the public and the taxpayer."

"Scope and Value of Water Works Schools," a panel discussion by six water and health officials. *Journal Am. W. W. Ass'n*, October.

Solids-Contact Process Basins

The A.W.W.A. Committee on Capacity and Loadings of Water Treatment Processes is engaged in a study of the characteristics and performances of the Accelator, Hydrotreator and Precipitator type of basins. They found difficulty in selecting a general descriptive name for this type; "upflow basin," "short-period mixing and coagulation basin," "sludge blanket basin," and "solids-contact process basin (or reactor)" were considered, with the last selected tentatively. A questionnaire was sent to the 48 state departments of health, to consulting engineers and to some operators, and replies received from all the departments, 16 consulting engineers and 9 operators. Such basins were reported as operating in 29 states

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only, 6 of which had only 1 basin each. The majority replied that the clarification results of these and of the conventional settling basin were about equal. Most reported that the softening yield per unit of chemical added was as great as or greater than in conventional flocculation and settling basins. About 65% said they could not be used satisfactorily on turbid water. Eighty percent said they needed more attention and skill; and 70% that they were subject to more failures, probably because the necessary skill was lacking. Sixty percent reported this type to be less satisfactory than conventional units on water supplies of frequently varying chemical and physical characteristics.

H. O. Hartung — "Solids-Contact Process Basins"; *Jour. Am. W. W. Ass'n*, October.

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Tentative Recommended Practice for Inspecting, Repairing and Repainting Elevated Steel Water Storage Tanks, Standpipes and Reservoirs; approved by the Am. Water Works Ass'n, New England Water Works Ass'n and Am. Welding Soc. October, Pp. 1099-1117.

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Artificial Recharge of Ground Water Reservoirs. By *A. Nelson Sayre* and *V. T. Stringfield*, Geologists, U. S. Geological Survey. November, Pp. 1152-1158.

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Financing Municipal Water Works Improvements in Indiana. By *David N. Brewer*, attorney. November, Pp. 1185-1193.

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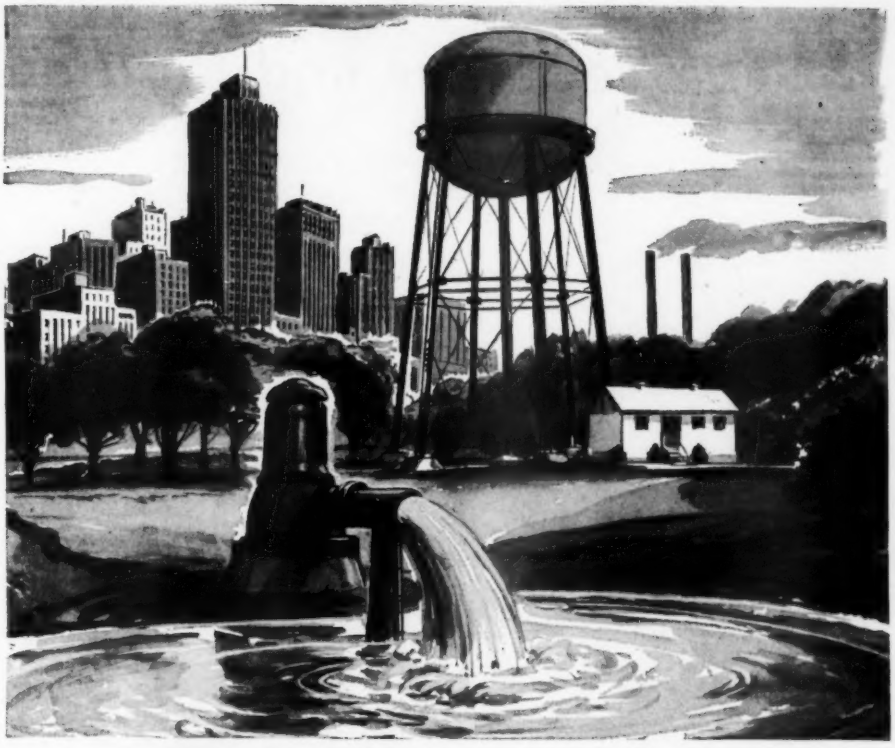

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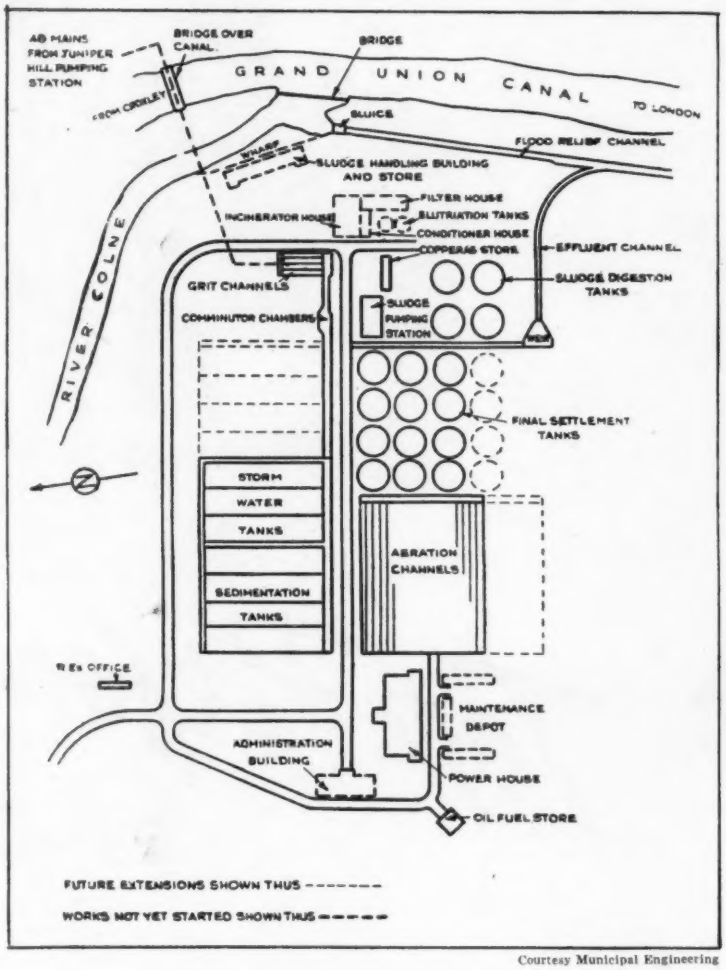
The Sewerage and Refuse Digest

Colne Valley Purification Works

The Maple Lodge works for treating the sewage from about 500,000 residents of the Colne Valley, England, are believed to be the first to adopt the standards of the Royal Commission for effluents (20 ppm of BOD and 30 ppm of suspended solids); with the additional one, requested by the Thames Conservatory and Metropolitan Water Boards, that "the effluent, when incubated for a period of five days at a temperature of 80° F. in a completely filled and stoppered bottle of not less than 125 ml capacity, shall be free from offensive odor and shall not become dark colored." (This high standard is set because the effluent will be discharged into a small river which joins the Thames above the intakes of the Metropolitan Water Board.) Also it is provided that sludge-drying beds, if any, shall be watertight, so that no drainage from them can enter the gravelly soil and pollute nearby wells.

To effect this purification, the plant will contain grit removal channels, comminutors, sedimentation tanks, activated sludge tanks, final sedimentation tanks, sludge digestion tanks, vacuum filters, elutriation tanks, flash drying and incineration. Capacities are based on an assumed flow 40 gpd per capita, with provision for 3 times this during storm water flow. The sedimentation tanks provide 7½ hr. retention of dry weather flow. The aeration units provide 12 hr. aeration, with ridge and furrow arrangement of diffusers, allowing 1.5 cu. ft. of air per gallon treated; pumps to be capable of returning 65% activated sludge. There are 4 sludge digestion tanks, 3 heated by coils and providing a capacity of 0.9 cu. ft. per capita; all tanks having floating gas holders. Dual-fuel diesel engines, using digester gas, will furnish all the power needed. Only primary sludge is digested, but surplus activated sludge as well as digested will be vacuum filtered. Provision is made for drying either digester or activated sludge, or both, for use as fertilizer, or for incinerating either or both.

W. Fillingham Brown—"The Maple Lodge Sewage Purification Works of the Colne Valley Sewerage Board"; *Municipal Engineering*, Oct. 1.



Courtesy Municipal Engineering

Plan of the Maple Lodge Works.

Sludge Concentration in White Water Treatment

The author describes, with data, studies made on the effect of flotation induced by high-speed mixing and chemical treatment, and also the effect of coagulants, on dewatering white water sludges, which led to the following conclusions:

In general, settling or flotation and vacuum filtration applied successively could decrease the moisture content of the sludge from 99-99.5 to about 70 per cent, thus decreasing the water to solids ratio from 99 to 1 to 2.3 to 1.

The buoyant effect of gases evolving can be greatly increased by supersaturation, artificially induced, causing sludge concentration by flotation rather than by settling.

Flotation is more effective than gravity settling in the dewatering of white water sludge.

Lime was found to be a better filter aid than diatomaceous earth in the vacuum filtration of paper tissue sludge. The latter, however, is applicable in cases where reuse of fibre is desired.

Alum is more effective than lime in vacuum filtration of paperboard sludges.

It is necessary to have a slurry of at least 1.5 to 2.0 per cent solids by virtue of the sludge solids concentration per se or by virtue of filter aid addition in order to obtain a filter cake of sufficient thickness to make vacuum filtration feasible.

Willem Rudolfs and A. J. Palladino —"White Water Treatment and Recovery"; *Water and Sewage Works*, November.

Opinions About Kitchen Garbage Grinders

Health departments of the 48 states were asked their opinions about kitchen garbage grinders, and 29 replied. In general, their opinions were that the use of such grinders was not likely to become general enough to create a very important problem; that an ordinance banning them is impracticable. However, two states thought that their use would be a step forward in public sanitation since it helps solve fly and rat

problems; others, that those using sewer service charges could increase them to compensate for the additional cost of treatment. (Canton, O., adds an extra charge of $3.50 per year to the standard sewer rental charge for those households having garbage grinders.)

"Kitchen Garbage Disposal Means Sewage Plant Expansion" and "What Other State Departments of Health Think About Kitchen Grinders"; *American City*, November.

Treating Tomato Canning Wastes

A study of results obtained with chemical treatment of tomato cannery waste, using various types and dosages of coagulants, showed that lime was the most efficient and lowest in cost. With a lime dose of 4.2 lbs./1000 gals. reduction of 99% suspended solids and 25% BOD were obtained. Optimum clarification and BOD reduction occurred at pH values of 3.4-3.5 and 10.0-10.5. Of the various types of hydrate and quick-limes used, high calcium hydrate was found best for purification and sludge volumes produced. Settling of coagulated material was rapid (½-1 hr.), but sludge volumes were relatively large, 160-180 gals./1000 gals. waste) resulting in a sludge with less than 0.2% solids. Vacuum filtration of sludge appears to be difficult and costly.

By R. Y. Le Vine—"Lime Treatment of Tomato Canning Waste"; PUBLIC WORKS, October.

Pollution Load Capacity of Streams

It has been shown that the oxygen balance in a stream not only indicates but controls the state of its self-purification. Calculations of load capacity based upon this, however, are difficult and the formulas complicated, due largely to the difficulties in estimating the constants that express the effect of turbulence and degree of biochemical activity in the stream. These constants are: For determination of rate of deoxygenation, k_1, reflecting the availability of the organic matter and the number and activity of the organisms present; for rate of reaeration k_2, reflecting the degree of turbulence and the transfer efficiency of the air-water interface film; for rate of deposition, k_3 reflecting the composition of the waste and receiving water and the quiescence of the stream at the point under consideration, (being negative in the case of scouring of the channel). Each of these varies with temperature and turbulence of flow, but in estimating load capacity they should be selected to represent the critical period, generally that of warm weather and low flow, or periods of high pollution by seasonal industries. The author suggests simplified methods of determining the constants for a given stream, including the use of nomograms.

Harold Allen Thomas, Jr.—"Pollution Load Capacity of Streams"; *Water and Sewage Works*, November.

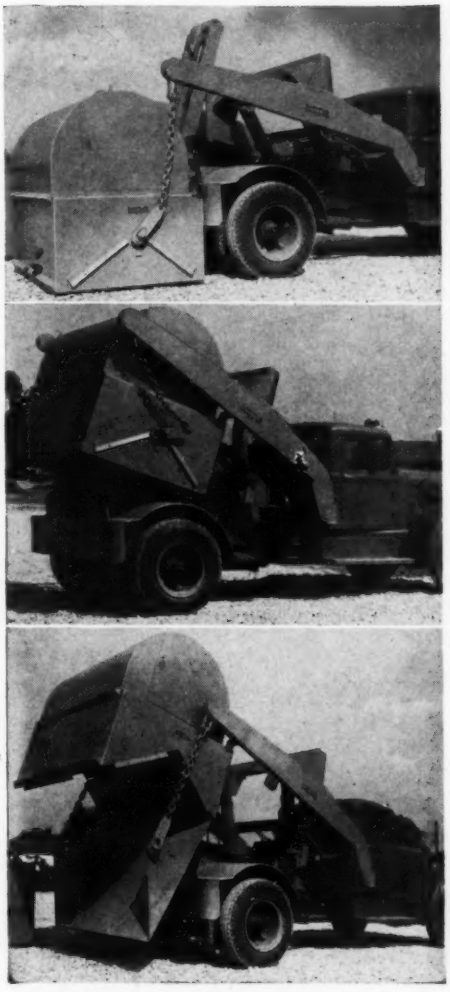
Explaining Sewer Rental Rates

Belleville, Ill. is financing $1,200,000 of improvements to its sewerage system and treatment plant by issuing revenue bonds supported by sewer rental rates. The rates decided upon are based on the facts that 60% of the proposed expenditure will be for handling volumetric flow and 40% will be chargeable to strength of the sewage; and that the average BOD of the city's domestic sewage was close to 200 ppm. If all the sewage, industrial and domestic, had a BOD content of 200, a rate based on volume alone would be consistent. The plan adopted was to use this as a base, and add to it 40% of 1/200 for each ppm of BOD in excess of 200 ppm.

The city officials held a meeting with the larger industries of the city to explain the method to them, but they could not seem to grasp it. To make it more understandable, the actual flow and BOD of the wastes at each plant were determined and the daily output of products, and the rate chargeable to each unit of output calculated—8.3 cts. per bbl. of beer, 16 cts. per hog at a packing house, 1/3 ct. per case of catsup, etc. This calculation gave the industries tangible figures that meant something definite to them.

George S. Russell—"Selling Sewer Rental to Industry;" *Water and Sewage Works*, October.

No Two Cities Have Exactly The Same Trash and Rubbish Collection Problem...



It's true! No two cities have the same problems of Trash and Rubbish Collection. In fact, no two parts of any one city have the same problems. In downtown areas, high concentrations of bulk rubbish must be collected almost daily; in housing centers some collections are made twice weekly and in residential districts one collection a week is sufficient. That's why in every city, a flexible system is needed. The Dempster-Dumpster System of rubbish collection meets every requirement.

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The amazingly simple stages of pick-up, hauling and dumping the detachable containers are shown in the three photos above. In the top photo, driver has backed the truck hoisting unit up to the 8 cu. yd. apartment type container, attached two chains and returned to the hydraulic controls in the truck cab. In center photo, container has been hydraulically lifted into carrying position ready for hauling to disposal area for automatic dumping as shown in the bottom photo.

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A Study of Second-Stage Filters

Prior to the war two treatment plants in Minnesota were reconstructed from single fixed-nozzle filter plants to 2-stage plants, using the fixed-nozzle filters as a second stage and constructing a new first stage with high-rate filters. At about the same time two high-rate 2-stage plants were constructed, not including recirculation except enough to keep the filter wet during low night flow. After these had all been operating about 8 years a comparison was made of their records, from which the authors concluded definitely that "the biology of two stages of a two-stage plant are radically different." Also "in order to maintain an active, virile flora, the minimum loading of organic material in the waste must be considered as well as the maximum loading." Comparing low-rate filters with fixed nozzles and those with rotary distributors, with equally sound design, they found that both will produce very close to identical removals.

Hugh C. Leibee and Randolph L. Smith—"Second Stage Filter Removals Without Recirculation"; PUBLIC WORKS, November.

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Construction Methods

Sewer Outfall Precast on Shipways. November, Pp. 36-39.

Engineering News-Record

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Enlarging an Activated Sludge Plant. Oct. 14, Pp. 97-99.

Sanitary Sewer Design Formulas. By *Richard Bennett*, hydraulic city engr., Phoenix, Ariz. Oct. 14, Pp. 102-105.

Clearing House for Sanitary Engineering. By *Edward J. Cleary*, Editor Eng. News-Record. Oct. 28, Pp. 92-94.

Storm Drain Design Shortcomings Under Scrutiny in Maryland. By *James R. McComas*, Asst. Engr. State Dept. of Health. November, Pp. 91-92.

New Sanitary Sewers for Gary Steel Mills. Nov. 11, Pp. 100-105.

Full Mechanization Aids Driving 13-Mile Sewer Tunnel. By *G. L. Smith*. Nov. 11, Pp. 107-109.

Municipal Engineering (England)

The Maple Lodge Sewage Purification Works. By *W. Fillingham Brown*. Oct. 1, Pp. 179-181.

Public Works

U. S. to Help Stop Pollution (the Taft-Barkley Act). November, Pp. 19-20.

Second Stage Filter Removals Without Recirculation. By *Hugh C. Leibee* and *Randolph L. Smith*. November, P. 22.

Plans to Reduce Pollution of the Merrimack River. November, P. 26.

Interim Report on Results of Sanitary Research at University of Florida. By *John E. Kiker, Jr.*, Assoc. Prof. of Public Health Eng. November, Pp. 32-33.

Sewage Works Engineering

The Materials of Sewage Works Construction. By *J. O Heek*, Div. of Municipal Planning, N. Y. State Pub. Wks. Dept. November, Pp. 582-583.

Aeration Plant to Protect Toledo's Lake Water. By *A. H. Niles*, Engr.-Supt. of Sewage Disp. November, Pp. 587-589.

Better Sludge Filtration at Detroit. November, Pp. 589-591.

Chicago Sanitary District Enlarges Plants and Sewers. By *Wm. Dundas*, Gen'l Supt. November, Pp. 591, 607.

U. S. Agencies Issue Statement on Federal Pollution Control. November, P. 594.

The Cause and Cure of Bulking. By *Morris M. Cohn*. November, Pp. 598-599.

The Surveyor (England)

High-Rate Trickling Filters. Discussion of *Greeley's* paper. Oct. 1, Pp. 511-512; Oct. 8, Pp. 523-525.

Water and Sewage Works

Prestressed Reinforced Concrete Pressure Pipe. By *M. W. Loving*, concrete technologist. November, Pp. 379-384.

Pollution Load Capacity of Streams. By *Harold A. Thomas, Jr.*, Assoc. Prof. of San. Eng., Harvard University. November, Pp. 409-413.

White Water Treatment and Recovery: Physical and Chemical Methods of Sludge Concentration. By *Willem Rudolfs* and *A. J. Palladino*, chief and research assistant, Rutgers University. November, Pp. 419-423.

The Bacteriostatic Effect of Methylene Blue on the B.O.D. Test. By *W. E. Abbott*, chemist, Sewage Disp. Dept., Nottingham, England. November, Pp. 424-425.

The Highway and Airport Digest

Specialized vs. Versatile Earthmoving Equipment

Some earthmoving equipment will work with peak efficiency on specialized jobs, others with acceptable efficiency on a variety of jobs. In general, large rubber-tired self-propelling earthmovers are in the former class, and crawler tractors with their various equipment are in the latter. In only exceptional cases are the two competitive; a contractor whose operations are extensive enough to afford specialized equipment for each job is not interested in versatility. But the majority of contractors need machines that can be used on a succession of jobs, in some of which the high speed of rubber-tired prime movers might be made useless by extremely short hauls or the necessity of dressing the haul road for each trip. In deciding what equipment to purchase, a contractor should consider the cost of owning each kind; of operating it; the working condition, both current and anticipated; the climate; availability of servicing facilities; and contingencies. Cost of ownership is calculated per hour for the time it will presumably be used during a useful life of 4 to 6 yr. Cost of operating includes not only fuel, oil, servicing and repairs but also cost of pushing during loading or special maintenance of haul roads, should these be necessary. If the working conditions should include slippery soil, ice, swampy areas or short hauls, rubber-tired equipment would be at a disadvantage. As to length of haul, tractor-mounted bulldozers are recommended for hauls up to 300 ft.; crawler tractors and scrapers for 300 to 1000 or 1500 ft.; high-speed rubber-tired units for longer hauls. (Crawler tractors are now available with speeds up to 7.8 mph.) If local distributors do not carry a complete stock of spare parts, time out for getting a part from the factory may cause serious delay to the work.

E. A. Braker—"Fitting Earthmoving Equipment to the Job"; *Eng. News-Record*, Oct. 28.

Subgrade Designing

The five fundamental principles of subgrade design are (a) adequate drainage, (b) maintain the grade line at lease 4 ft. above the water table, (c) remove all pockets of frost-heave soil, (d) remove all underlying deposits of peat, muck, and other soils high in organic matter, (e) Proctor compaction.

An investigation by Canada's Department of Transport indicated that the bearing capacity of the clay subgrade at one airport was increased by about 25% by compacting a 12-in. thickness from 85 to 95% of modified AASHO maximum density. For a 24-in. compacted depth the increase in bearing capacity was about 38%.

The supporting value of a subgrade depends upon the size of the bearing plate with which it is tested and upon the deflection specified.

Diagrams were derived by means of which load-test data for a single bearing plate and single deflection can be extrapolated to other bearing-plate sizes between 12 and 42 in. in diameter, and to any deflection from 0 to 0.7 in.

Relationships have been established between subgrade plate-bearing test results and four very simple tests—cone-bearing, Housel penetrometer, field California bearing-ratio, and triaxial compression.

Base-course support per inch of thickness seems to be independent of the composition of granular base-course materials, but appears to be influenced by base-course density.

Bituminous pavements that have been in service for a time have greater supporting value per inch of thickness than granular base-courses, but the reverse appears to be true for newly constructed bituminous surfaces.

The load test data indicate that the supporting value of a granular base-course per inch of thickness depends directly upon the supporting value of the subgrade upon which it is placed.

Norman W. McLeod — "Subgrade and Base Course Design"; *Roads and Bridges*, September.

Snow Removal In Lansing, Mich.

In Lansing a winter's snowfall sometimes totals 70" to 80". All of this is hauled away from 8 mi. of the city's major streets and dumped into the Grand river through openings in the sidewalks of a bridge. When the snowfall exceeds 6", the remaining 186 mi. of city streets and 300 mi. of sidewalk are plowed; also the alleys are plowed if there is time before the next storm. The equipment used includes 16 10-ft. plows on 3-ton trucks and motor graders, a Snogo, 7 10-yd. trucks and 26 sidewalk V-plows. It is proposed to buy 8 more street plows. At the start of any storm, rock salt is spread mechanically at all dangerous intersections, on downtown streets, and bus and arterial routes. Abrasives are no longer used, as they were tracked into buildings, clogged the sewers, and had a serious abrasive action at corners due to the stopping, starting and turning of vehicles. Also salt is cheaper—sand costs $1.75 per cu. yd. at the point of application. On downtown streets, plowing starts when 4" of snow has fallen, a windrow being formed near each curb. Beginning at midnight, snow removed from the sidewalks is plowed into these windrows, leaving the gutters open, and an hour later the snow loader begins and continues until it is all removed.

Engineering News-Record, Oct. 14.

Laying 3600 Tons of Airport Pavement a Day

Chicago Municipal Airport is repaving asphalt and concrete runways and taxiways 10 or 12 yr. old which had so deteriorated that in some places 6" of black base was required to restore the crown. In doing this, runway surfaces were first primed with 0.1 gal. of RC-O per sq. yd., followed by binder and surface courses, both of which were asphaltic concrete containing 55% limestone, 33% sand, 5% limestone dust and 6% asphaltic cement.

Badly broken 7" concrete slabs were broken into 1-man pieces with a 3,000-lb. hammer mounted on a truck, at the rate of 200 sq. yd. an hour, and replaced with patches 10" thick. Asphalt pavement was laid with four 10-ft. Barber-Greene pavers at rates as high as 3600 tons in a 9-hr. day. The asphalt was mixed in three plants 7 to 14 miles away and hauled by 48 12-ton and 14-ton trucks, two of which left the main plant every 10 minutes on an exactly maintained schedule.

Harold M. Maxwell — "Teamwork, Trucks and Timing Payoff at Chicago Municipal Airport"; *Roads and Streets*, October.

Tar-Soil Stabilization

According to A.R.B.A., all sands classified as A-3, stabilized with tar, should be referred to as "tar-sand stabilization"; the use of any other suitable soil as "tar-soil stabilization."

In view of the findings of the A.R.B.A. Committee on Tar Stabilized Roads and the experience of the Corps of Engineers with tar-sand stabilized base courses on airfields, it is believed that the following conclusions are justified:

1. The use of tar-soil stabilization should be considered for base courses where economy may be effected and the soil indicates suitability.

2. Good performance may be expected from soil-tar stabilized base courses provided the soil possesses proper characteristics.

3. Soil-tar stabilization should be considered only for that portion of a

flexible pavement considered to be the base course.

4. Properly designed and constructed tar-sand stabilized base courses of adequate thickness have given satisfactory performance on military airfield runways.

Walter C. Ricketts—"Tar Soil Stabilized Base Courses"; *Roads and Streets*, October.

Snow Handling In North Dakota

The winter of 1947-48 brought to North Dakota's 6508 miles of State highways the heaviest snowfall on record—an average for the state of 45.8" and a maximum of 84.3". It cost $817,000 for snow removal and $115,000 for snow fences and ice control. The equipment operated for snow removal comprised the following:

14 V-type motor grader plows
11 One-way plows for 1½-ton trucks
87 V-type plows for 1½ to 3 ton rear wheel drive trucks
49 V-type heavy duty plows for four wheel drive trucks
9 Rotary "snogo" plows
13 Snow wings for four wheel drive trucks
19 Snow wings for motor graders
98 1½ to 3 ton trucks, rear wheel drive
49 3 to 10 ton trucks, four wheel drive
75 Heavy-duty motor graders

These cost more than $1,000,000. It would cost $3,000,000 to obtain additional equipment sufficient to keep all the state highways open for traffic during such a winter as the past one.

For the first snowfall, which is usually slushy, motor graders and one-way plows are used; followed, if necessary, by light-duty V plows traveling 25 to 40 mph. When the snow is deeper, V truck plows open the roads for traffic, followed by motor graders with plows and wings for widening. When drifts become 5 to 15 ft. deep, 4-wheel-drive trucks with V's and rotarys are used.

Ray Robinson — "North Dakota's 'Worst Winter'"; *Roads and Streets*, October.

Snow Handling In St. Paul, Minn.

St. Paul clears 210 miles of snow on a primary schedule, followed by a secondary schedule of 500 miles. Snow operations usually last from Dec. 1st to March 15. Snow falls for the winter vary from 15" to 80". The city has 43 straight-blade reversible snow plows, which it mounts on street flushers and oil distributors, and on city-owned trucks used by the various bureaus; 8 motor patrols with 12 ft. blades and scarifiers, a V-type plow and wing, a 5-ton tractor and V plow, a 4-wheel-drive truck with V plow and wing, 4 all-purpose loaders and 2 snow loaders. All plowing equipment is provided with a distinctive blue light on each side of the cab in front and a similar light in the rear. Plows are operated in echelons of 2 or 3. In the business district, snow is removed between 11 PM and 8 AM and dumped into sewers.

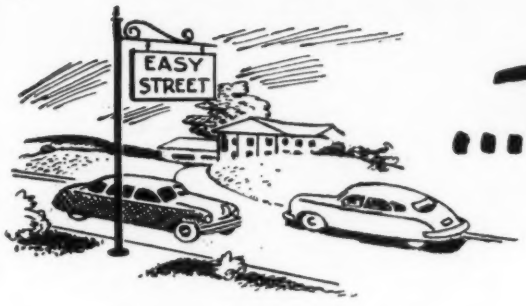
Wright S. Cockroft—"How St. Paul Keeps Its Streets Open in Winter"; *Roads and Streets*, October.

Snow Handling On Michigan Highways

The Michigan State Highway Dept. has 9,400 miles of state trunk lines to keep free from snow and ice. For this it now owns 180 snow plows, 120 ice sanders and 12 rotary plows. As soon as a snow storm starts, trucks equipped with underbody blades start clearing traveled roads before the snow is packed by traffic. As the snow gets deeper, light trucks with side-delivery plows take over, then heavy trucks with side-delivery plows; followed by rotary wing plows to slice off the banks. When a layer of snow glazes over, causing an icy condition, chemically treated abrasives are applied, followed by trucks with scrapers to peel off the loosened ice. Ice control takes about 75% of the winter maintenance money in the southern part of the state, 50% in the central part and 25% in the northern part, the rest being used for snow removal and snow fences.

C. M. Zeigler—"Michigan Prepares

Putting Motorists on Easy Street



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for Winter"; PUBLIC WORKS, November.

Non-Skid Asphalt Surfaces

"All Nova Scotia pavements are non-skid"—although there are occasional drivers who are not. These non-skid pavements are plant-mix asphaltic pavements of the comparatively open grade type, with the asphaltic content controlled as strictly as possible, but with too little asphalt rather than too much. After a time they are seal coated with great care, using ¼ gal. of asphalt per sq. yd. immediately blanketed with stone chips and rolled. Plenty of chips are used; if there are not some loose chips along the edges of the road after a few weeks it is an indication that not enough were used. "Slippery asphalt pavement surfaces are caused by too much asphalt, and the dense-graded type of pavement, being more sensitive to an overdose of asphalt than the open-graded type, is more liable to become slippery."

James L. Wickwire—"Non-Skid Asphaltic Surfaces"; *Roads and Bridges*, September.

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Fitting Earth Moving Equipment to the Job. By *E. A. Braker*, International Harvester Co. Oct. 28, Pp. 80-82.

Prestressed Cast - in - Place Concrete Bridge. Nov. 11, Pp. 83-85.

Public Works

Double Arch Waterway Replaces Bridge. By *Austin L. Myers*, Supt. H'way Dept. of Daviess Co., Ind. November, P. 21.

Michigan Prepares for Winter (Snow Removal). By *C. M. Zeigler*, State H'way Com'r. November, Pp. 25-26.

Putting Through a 55-Mile County Road Program. By *Neil Woodle*, H'way Supt. Meade Co., S. D. November, P. 31.

Roads and Bridges

Subgrade and Base Course Design. By *Norman W. McLeod*, Imperial Oil Ltd. September, Pp. 96-104, 176.

Solving Traffic Congestion Problems in Urban Centers. By *Bertram D. Tallamy*, Supt. Pub. Wks. of N. Y. State. September, Pp. 106, 108, 112, 114, 116, 118, 120, 201.

Progress in Cement-Concrete Highway Design and Construction. By *E. F. J. Clark*, Canada Cement Co. September, Pp. 122, 124, 195.

Non-Skid Asphaltic Surfaces. By *James L. Wickwire*, Asst. Chf. Engr., Nova Scotia Dept. of Highways. September, Pp. 128, 190.

Service Difficulties with Road Building Machinery. By *K. A. Forbes*, Mech. Engr., Nova Scotia Dept. of Highways. September, Pp. 130, 132, 188.

Roads and Streets

Teamwork, Trucks and Timing at Chicago Municipal Airport. By *Harold M. Maxwell*. October, Pp. 51-53.

5,779 ft. of Concrete per Day. October, Pp. 57-61.

Tar Soil Stabilized Base Courses. By *Walter C. Ricketts*, office of Chief of Engineers, War Dept. October, Pp. 77-79, 102.

A Low-Cost Concrete Bridge. By *B. A. Trice*, Texas H'way Dept. October, Pp. 83, 85.

North Dakota's "Worst Winter." by *Ray Robinson*, Maint. Eng'r, N. D. H'way Dept. October, Pp. 81-82.

How St. Paul Keeps Its Streets Open in Winter. By *Wright S. Cockroft*, Supt. of Construction & Repairs. October, Pp. 93-94.

Day Labor Increases Cost of Airports. By *Walter R. Macatee*, Am. Road Builders Ass'n. October, P. 98.

Road Maintenance Costs. By *S. E. Ridge*, Public Roads Administration. October, P. 99.

The Surveyor (England)

Some Safety Aspects of Road Surfaces. By *Reginald A. Kidd*, County Surveyor of Nottinghamshire. The Surveyor, Oct. 22, Pp. 547-548.

Marking of Pedestrian Crossings. By *Robert Bruce*, City Engineer of Glasgow. P. 553.

Wegen (Holland)

International Congress of Earth Machinery at Rotterdam, June 1948. October, Pp. 188-205.

Pumps for Cincinnati Water Works

In the new Tennyson Ave. Pumping Station of the Cincinnati Water Works, there will be six electric-driven centrifugal pumps with a total capacity of 145 mgd.: two of the pumps will be 2-stage, 25 mgd. each, with 3,000-hp. motors; one 2-stage, 20 mgd., with 2,500-hp. motor; three single-stage, 25 mgd. each, with 1,250-hp. motors. The pumps will be furnished by Worthington and the motors, controls and accessory equipment by General Electric.

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CONSULTING ENGINEERS

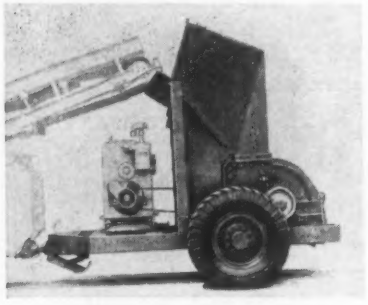
Your professional card belongs in this directory of leading engineer specialists, where it will be seen by those who employ consultants. For rates, write:

PUBLIC WORKS Magazine, 310 East 45th St., New York 17, N. Y.

PUBLIC WORKS Equipment News

Portable Crusher for On-the-Road Work

Designed primarily to be towed behind an Athey force-feed loader, this



Athey portable crusher.

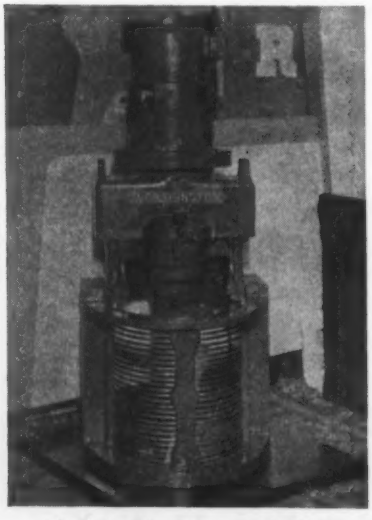
crusher is a valuable addition to maintenance and construction equipment. It is one-man operated and it picks up scarified or broken material from the road, crushes it and deposits it back on the roadway in one continuous operation. It is self-powered and mounted on rubber tires. Overall length is only 13½ ft. Specially valuable for county highway work. *Athey Products Corp., Chicago, Ill.*

Use coupon on page 77; write in No. 1-12

Worthington Comminutor for Sewage Solids

This is a new unit with several features for which special advantages are claimed. The screen retains all material too large to pass through the 5/16" slots. An oscillating arm, fitted with a rack of stainless steel cutters, collects the material momentarily accumulated on the inner surface of the screen and, with a stationary cutter, reduces these solids to a selected workable size. Installation requires only the provision of four foundation bolts in any existing channel, since the raw sewage flows straight through the screen. No special channel design is required. Full information from *Public Works Division, Worthington Pump & Machinery Corp., Harrison, N. J.*

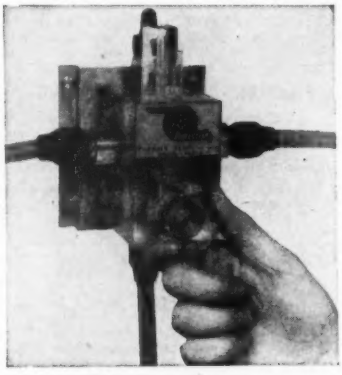
Use coupon on page 77; write in No. 2-12



The Worthington comminutor.

Automatic Hypochlorite Feeder for Small Installations

An automatic hypochlorite feeder has been developed which is suitable for a water system of any pressure. It operates on a vacuum principle with no moving parts. It is constructed of clear plastic, impervious to the action of chlorine. It is equipped with a testing unit for visual control of the chlorine content of the water. It is easy to install and it can be used for feeding other water-soluble chemicals. It is specially adapted to installations at camps, isolated homes, factories, plants, etc. *Paddock Engineering Co., Dallas, Tex.*, will send full data.

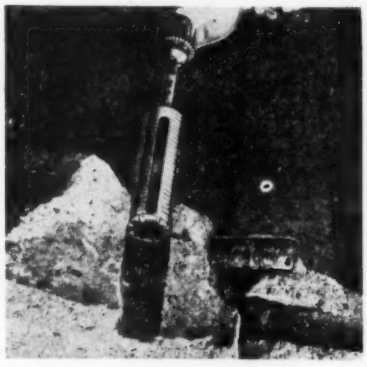


Paddock hypochlorite feeder.

Use coupon on page 77; write in No. 3-12

Rotary Drill for Concrete

It is claimed that this rotary drill will produce substantial cost-per-hole savings. It penetrates concrete at the rate of 2" or more per minute in diameters from ¼" to 2". Glass, steel and rock imbedded in the concrete are easily cut. Cutters can be resharpened. These drills are used with ordinary electric drill motors and are available from ¼" to 2¼". Core drills can be furnished. *Tilden Tool Mfg. Co., 1995 N. Fair Oaks Ave., Pasadena 3, Calif.*

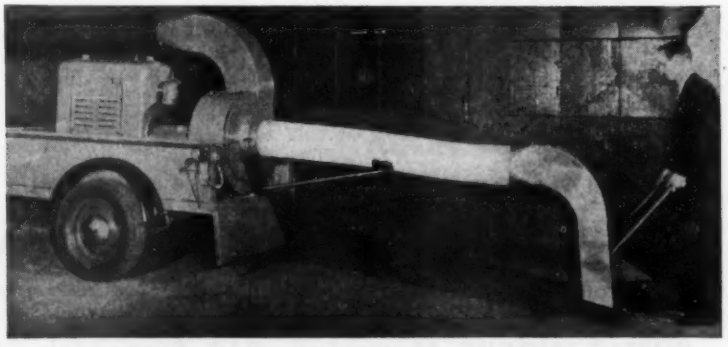


For rapid concrete drilling.

Use coupon on page 77; write in No. 4-12

Pneumatic Leaf Pick-Up Machine

This machine is mounted on a trailer and is operated by a gasoline engine. It has a wide suction nozzle for trailing



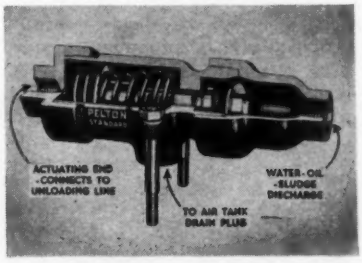
The General vacuum street cleaner and leaf remover.

along to pick up leaves from the street, and a supplementary extension hose for reaching off-street deposits. The discharge from the unit is to a dump truck. The nozzle can be guided by one man so as to clean the entire area most effectively. *General Blower Co., Morton Grove, Illinois.*

Use coupon on page 77; write in No. 5-12

Moisture Ejector for Air Tools

Whenever an air compressor cuts in or cuts out, this valve operates to remove all water, oil and sludge from the



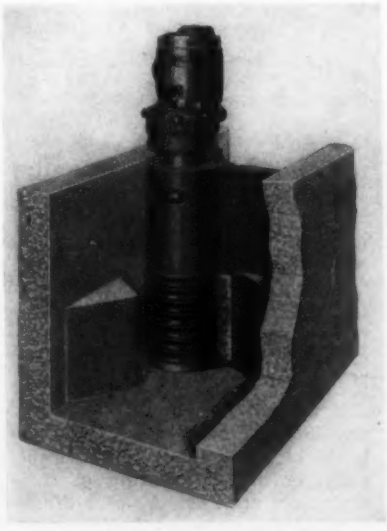
Compressed air cleaner.

air, reducing or preventing stoppages and difficulties with air tools. Tank pressure furnishes the motive force. By maintaining clean, dry air, this valve eliminates danger of freezing or clogging and extends the life of parts of the air operated equipment. *Monroe Standard, Inc., Galion, Ohio.*

Use coupon on page 77; write in No. 6-12

Improved Infilco Griductor for Sewage Treatment

This new unit is designed primarily to intercept and cut larger sewage solids by screen and grid action, thus protecting plant equipment such as pumps, clarifiers, etc. The Griductor can be installed in existing sewage screen channels, and special forms and complicated concrete work are not required. Long life is assured for the cutter teeth by a special design, by providing reversibility and by the use of durable material. A good bulletin, No. 5100, is available. *Infilco, Inc., 325 West 25th Place, Chicago 16, Ill.*



Improved Infilco Griductor.

Use coupon on page 77; write in No. 7-12

Metallic Filter Medium

The Neva-Clog filter medium consists of two precision-perforated metal sheets welded together. The holes are accurately perforated with holes about 0.045 in. diameter to provide 120 holes per sq. in. The sheets are spot-welded together on about 1-inch centers, the holes being staggered over the unperforated portions of the lower sheet. The filter is claimed to be non-clogging and the cake is readily removed; it can be furnished in drums, cylinders, discs, etc. An instructive and interesting data sheet is available. *W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn.*

Neva-Clog filter medium.

Use coupon on page 77; write in No. 8-12

When you need special information—consult the READERS' SERVICE DEPT. on pages 77-80

Combination Emergency Lamp and Signal Flare

Use coupon on page 77; write in No. 9-12

The many uses of this combination unit suit it for contractors, city or county construction work, airports, and emergencies. It gives either a steady light or 110 flashes per minute. Batteries will give 28 hours of flashing or 20 hours of continuous light; longer if used intermittently. Two bulbs are used to insure continuous service. It operates in any position. *U-C Lite Mfg. Co., 1050 West Hubbard St., Chicago 22, Ill.*

Handy flasher and light.

Exterior Heat Resisting Aluminum Paint

Use coupon on page 77; write in No. 10-12

Permite 1901 is a new type of ready-mixed paint designed to resist heat up to 1000° F. without blistering or peeling even when hard rains hit very hot surfaces. It is used for steam pipes, smokestacks, manifolds, etc. *Aluminum Industries, Inc., Permite Paint Div., 2438 Beekman St., Cincinnati 25, Ohio.*

Pneumatic Vibrator

Use coupon on page 77; write in No. 11-12

This new vibrator has been widely accepted in concrete pipe production work, though it is equally well suited for other concrete construction. It weighs only 40 pounds and is 5½ ins. in diameter and 12 ins. long. Regulation of air pressure controls speed. Ask for data on Model PX-6. *Viber Co., Burbank, Calif.*

Five Ford Industrial Engines

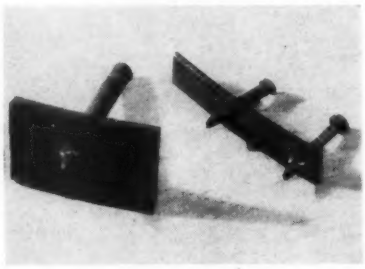
Use coupon on page 77; write in No. 12-12

Production of five Ford engines intended for the industrial and construction fields is under way. These engines are the 337 and 239 V-8; the 254 and 226 6-cylinder; and 120 4-cylinder. The numbers refer to cubic inches of piston displacement. These engines are designed for use in cranes, shovels, pavers, pumps, hoists, sweepers, cement mixers, crushers, compressors, loaders, and similar purposes. *Ford Motor Co., Dearborn, Mich.*

Steel Tools Hardened in Any Shop

Use coupon on page 77; write in No. 13-12

Drills, chisels, blades or any other steel tool can be deep-penetration hardened with a minimum of equipment and time by a process developed by Necamp Metallurgical Laboratories, using their "Hi-Speed-It" steel hardening compound. With an acetylene torch, forge or furnace as a source of heat, the object to be hardened is brought to a cherry red, dipped or rolled in the hardening compound, reheated to a cherry red to fuse the compound into the metal and then quenched in cold water. For greater penetration additional hardening compound may be applied before quenching and the object reheated a second time.

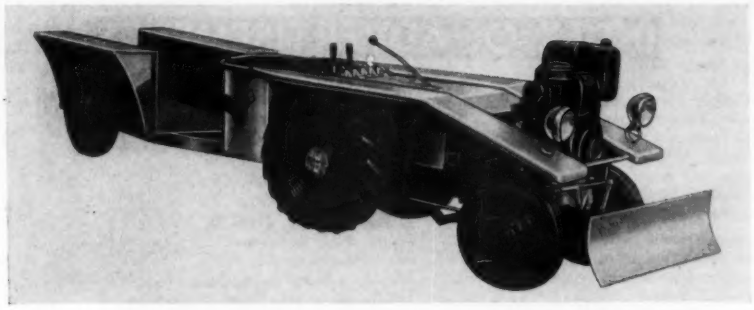


Nails made into cold chisels.

In a demonstration an ordinary nail was fashioned in the shape of a small chisel, sharpened, and then hardened with "Hi-Speed-It." This same nail was then used to cut a similar nail without the slightest sign of damage to the cutting edge. Similar treatment made effective cold chisels out of pieces of reinforcing bars.

Application of the compound does not change the dimensions of the tools. Due to the relatively deep penetration, tools may be resharpened many times before rehardening is necessary.

Contractors, water works men and city forces will find use for this material in the shop and on the job, wherever drilling, cutting or chipping tools are used. *Necamp Metallurgical Laboratories, 1 Mercer St., New York 13, N. Y.*



"Handy-Andy" small bulldozer, tower and pusher.

"Handy-Andy" Dozer

Use coupon on page 77; write in No. 14-12

This little unit stands 42" high and is twice as long. There are 3 speeds forward and reverse; turning radius is 6 ft. It is designed for clean-up work, backfilling, road and street maintenance, leveling, towing, pushing and excavating. The illustration shows some of the interesting features of this useful piece of equipment. More interesting information from *Central Mine Supply Co., Mt. Vernon, Ill.*

Nylon Cloths for Vacuum or Pressure Filters

Use coupon on page 77; write in No. 15-12

These Nylon cloths for rotary vacuum or pressure filters or filter presses are said to be remarkably resistant to acids, alkalies and bacterial action, and to last several times longer than the average cloth. They are also said to be very easy to clean, and to reduce blinding and plugging. Small sample of cloth sent on request. *Filtration Engineers, Inc., 155 Oraton St., Newark 4, N. J.*

Flow from Orifices

Use coupon on page 77; write in No. 16-12

Correctly designed orifice-type meters provide accurate measurements of the flow of liquids, steam or gases, providing the orifices or nozzles are properly sized. A new bulletin describes a simple method of attaining accuracy and contains a number of valuable graphs and formulas. Ask for Bulletin T-100-M "Capacity Data for Concentric Orifices & Flow Nozzles." *Hagan Corp., Hagan Bldg., Pittsburgh, Pa.*

A Fastener for Traffic and Directional Signs

Use coupon on page 77; write in No. 17-12

A short length of corrosion-resistant steel strap binds a sign or marker to a standard as permanently as special brackets. Advantages cited by the manufacturer are: The cost of mounting signs is greatly lowered; the operation of placing the sign is so simple that it can be performed in cold weather without removing gloves; can be used on large or small diameter, wood, steel or concrete posts of any shape. 4-page folder, SSM-3, is available. *A. J. Gerrard & Co., 221 N. LaSalle St., Chicago 1, Ill.*

Moving Dirt Cheaper

Use coupon on page 77; write in No. 18-12

R. G. LeTourneau, Inc., Peoria, Ill., a 4-page folder showing how nonproductive 'dozer time can be cut and how 'dozer work can be speeded up.

Devendorf Succeeds Holmquist

Earl Devendorf has been appointed Director of the Bureau of Environmental Sanitation, New York State Department of Health, succeeding C. A. Holmquist. Mr. Devendorf was graduated from Union College in 1912 (he and your editor sat side by side for four years at Union) and has been with the state for more years than either of us perhaps care to tabulate. Congratulations to both the state and Earl.

Jack Hinman Back in US

Col. Jack J. Hinman, Jr., in the army since 1940, has terminated his military service and is now back in the U. S. He can be reached simply by addressing him at Iowa City, though for the meticulous, we recall his address as 121 Melrose Ave.

Huber Completes New Foundry

A new gray-iron foundry has been completed and is now occupied by the Huber Mfg. Co., Marion, O. The new building, which is 110 by 240 ft., plus concrete material bins, is of brick and steel construction. It is another step in the long-range building program of this company, and provides modern and convenient facilities for the personnel employed by the company.

INDEX OF ADVERTISEMENTS

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These helpful booklets are free. Just circle numbers you want on coupon on this page and mail. Or write the manufacturer direct and mention PUBLIC WORKS. This service is restricted to those actually employed in public work.

NEW LISTINGS

Uniform Spreading 2 to 10 ft. Wide

1. Saves labor, spreads 0 to 100 lbs. a sq. yd., dusts up to 1" material forward, reverse, on curves, hills or straightaway. Assures uniform, even density of spread. Write for bulletin: Dept. PW., All Purpose Spreader Co., Fuller Road, Elyria, Ohio.

Air Cooled Engines for Hundreds of Applications

3. Tested under severest conditions of long, hard use, these engines have earned world wide recognition as the "right" power for hundreds of applications. Get latest bulletin from Dept. PW, Briggs and Stratton Corp., Milwaukee 1, Wisc.

Mow Clean and Fast In Tight Corners

4. Send for latest literature about the Cunningham Mower for Fence Rows, Parking Areas, Driveways, Picnic Grounds and many other jobs. 3 ft. cut, variable speed, rugged, easy to handle. James Cunningham, Son & Co., Dept. 16, 13 Canal St., Rochester 8, N. Y.

An Answer to that Troubling Termite and Decay Problem

5. Pentachlorophenol sounds forbidding. Termites can't read, but it keeps them out anyway and protects wood from decay too. Whether you use wood in highway guard posts, pump houses or other structures you should get the new booklet "Pentachlorophenol for Industry." Dow Chemical Co., Dept. PW, Midland, Mich.

Locate Mains and Services Without Digging

6. The M-Scope is an electronic method of definitely locating a metal pipe. By proper manipulation the depth of cover can be determined. It is battery operated and readily carried by one man. Used as directed in this 16-page booklet, it is easy to determine exact locations of valve and meter boxes. Fisher Research Laboratory, 1961 University Ave., Palo Alto, Calif.

Improved Spreader Speeds Job, Saves Labor

7. Two models of Flink Spreaders are controlled from cab, handle all granular materials. Spreaders are easily installed and do not interfere with dumping. Hydraulic gate control automatically closes gate when spreader is stopped. Get Bulletin M6, Dept. PW, Flink Co., Streator, Ill.

How to Make Sewage Plant Grit Suitable for Fill, Roadways

11. The Jeffrey "Jigrit" washer does a thorough job of scrubbing grit free of organic solids. Grit is classified according to size and organics rejected with overflow. 44-page Catalog 775A describes the "Jigrit" and gives engineering data and installation views of grit and sludge collectors, chemical feeders, garbage grinders and other equipment as well. Dept. PW, Jeffrey Mfg. Co., 948 N. Fourth St., Columbus 16, Ohio.

An Incinerator Necessity

17. Recuperator tubes made from Silicon Carbide and "Fireclay" corebusters for maximum efficiency are described and illustrated in Bulletin 11 issued by Fitch Recuperator Co., Dept. PW, Plainfield Natl. Bank Bldg., Plainfield, N. J.

Get the Latest Data On Main Sterilization

18. The many uses of Pittchlor in water supply systems are described in Bulletin A705 issued by Pittsburgh Plate Glass Co., Columbia Chemical Div., 5th at Bellefield, Pittsburgh 13, Pa. Information covers dosages, solution strengths, etc., for reservoirs, water works, mains, filters and emergency use.

How You Can Clean Sewers From Streets Easily and Inexpensively

23. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boulevard, Los Angeles 34, Calif.

Makes Underground Pipe Installations Easy

25. One-man operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117, Greenlee Tool Co., 2052 Columbia Ave., Rockford, Ill.

These Wheel Tractors Solve Many Hauling Problems

45. Specifications and full information about the new M-M wheel tractors in sizes 27 HP to 49 HP. Send for copies today. Dept. PW, Minneapolis-Moline Power Implement Co., Minneapolis, Minn.

How You Can Dispose Of Sewage Solids

54. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes — a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Dept. PW, Nichols Engineering and Research Corp., 70 Pine St., New York 5, N. Y.

Cast Iron Pipe and Fittings For Every Need

65. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Dept. PW, Burlington, N. J.

You Need These Accessories For Your Digester

69. Sewage Gas Control—flame traps, waste gas burners, regulators, condensate and sediment traps and other equipment for utilizing sewage gas. Catalog S-3. The Vapor Recovery Systems Co., 2820 N. Alameda St., Compton, Calif.

Tractors for Counties, Cities and Contractors

76. An attractive 24-page catalog portrays the Allis-Chalmers HD-5 crawler's abundant capacity and ability to meet the variable needs of counties, townships and contractors. Photographs and cutaway views illustrate its rugged construction and simplified maintenance. Use coupon or write Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee 1, Wisc.

How to Save Labor and Avoid an Unpleasant Job

78. Information on the new Worthington Comminutor for continuously and automatically shredding sewage solids is now available. Be sure to investigate this modern means of eliminating screening and laborious disposal of large, unsightly solids. Use coupon or write Dept. PW, Worthington Pump and Mach'y Corp., Harrison, N. J.

Job Data Offered on New Steel Water Lines

80. An 8-page illustrated report listing pipe diameters, pipe wall thicknesses, line pressures, coatings, engineering personnel, etc., is entitled "A Report of Dresser-Coupled Steel Water Lines in the Year 1947." A copy will be sent by Dresser Mfg. Div., Bradford, Pa.

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Handy Catalog Describes Small Hydrants, Drinking Fountains

115. This 44-page catalog describes ¾" to 2" hydrants. Also street washers, drinking fountains and other water service devices. The Murdock Mfg. & Supply Co., 426 Plum Street, Cincinnati 2, Ohio.

The Right Tractor for Your Job

116. Whether you need a front-end loader, snow plow, bulldozer, sweeper or mover, International wheel tractors combine correctly with allied equipment to do the job. Your choice of gasoline or diesel units is illustrated in Bulletin A-103JJ. International Harvester Co., 180 No. Michigan Ave., Chicago 1, Ill.

CONSTRUCTION AND MAINTENANCE

Special Pumps to Fit Any Dewatering Job

101. Centrifugal Pumps. Long lasting, self-priming, non-clogging pumps for quickly dewatering trenches and similar construction jobs. Ask for Bulletin 7-LW-13. Gorman-Rupp Co., 320 No. Bowman St., Mansfield, Ohio.

Light Weight Machine Does Work of Heavy Roller

111. For compacting hot or cold patching material be sure to investigate the Wayer Impactor. 2,000 blows per minute tamps, finishes and cures. All data in Bulletin 25-8. Wayer Impactor Sales Co., 12 N. Third St., Columbus 15, Ohio.

Here's the "Wood-Cutting Wizard"

89. Don't wait until storms have broken limbs and felled trees before finding out about the new light-weight engine powered chain saw announced by McCulloch. Ideal for all contracting and tree-maintenance operations. Get bulletin from McCulloch Motors Corp., Dept. MP, 6101 W. Century Blvd., Los Angeles 45, Calif.

Strong, Speedy, Low-Cost Maintainer Has Many Uses

22. BG Maintainer, a powerful speedy, low-priced machine for light road maintenance. Full details in illustrated folder. Huber Mfg. Co., Dept. PW., Marion, Ohio.

Portable Power Tools For Every Purpose

84. A new, profusely illustrated 22-page catalog gives data and applications of portable power tools, including self contained gasoline hammer paving breakers, a variety of concrete vibrators and electric hammers, drills and grinders. Get catalog 486 from Syntron Co., 660 Lexington, Homer City, Pa.

Diesel Engines to Help You Build Profits

27. A new 28 page catalog just off the press titled "Superior Stationary Diesel Engines," is packed with facts that will help you build profits. For your copy write to Superior Engine Division, National Supply Company, Springfield, Ohio.

STREETS AND HIGHWAYS

Just Right for Fast, Small Asphalt Mixes

90. The Foote Kinetic Mixer delivers 3 cu. ft. in 30 seconds. Portable and easily operated. Get Bulletin K-100 from The Foote Co., 1954 State St., Nunda, N. Y.

Grading Can Be Faster, Cheaper and Easier

96. You'll like every feature of the Austin-Western 99H Grader. It has all-wheel drive, all-wheel steer, controlled traction, precision sideshift and a high lift, extreme reach, reversible blade. Get data from Austin-Western Co., Aurora, Ill.

SEWAGE DISPOSAL

Need Low-Cost Air For Sewage Treatment?

39. New booklet on Centrifugal and Rotary Positive Blowers engineered to fit your needs: air for activated sludge; constant vacuum for filters; priming centrifugal pumps; measuring sludge gas; water treatment. Write Roots-Connersville Blower Corp., 712 Poplar Ave., Connersville, Ind.

How Cities Can Do Complete Sewer Cleaning From Street

98. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Power machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana.

Design Details for Sludge Collectors

42. Booklet No. P.W. 1742 on Link-Belt Circuline Collectors contains sanitary engineering data and design details. Catalog No. 1742 on Straightline Collectors, contains layout drawings, illustration pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

Aeration and Final Clarification In a Single Tank

92. The "Package Aerifier" for small sewage treatment plants employs the activated sludge process. Ideal for isolated institutions and industrial plants, and communities of 600 to 3500 population. Complete data in bulletin 6651 from Yeomans Brothers Co., 1425 N. Dayton St., Chicago 22, Ill.

Non-Corrosive, Long Lasting Low Cost Sewer Pipe

33. Get this new engineering data on clay pipe for sewers. Withstands acid, alkali and gas attacks indefinitely. Cuts maintenance costs to a minimum. Write Dept. P.W., National Clay Pipe Mfrs., 111 W. Washington St., Chicago 2, Ill.

Save Trucks and Labor In City Rubbish Collection

35. For saving trucks, labor, and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Brothers, Inc., 996 Higgins, Knoxville 17, Tenn.

Packaged Sewage Treatment— Just Right for Small Places

36. "Packaged" Sewage Treatment Plants specifically developed for small communities — 100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

Solve Corrosion Problems With This Special Alloy

41. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. Dept. P.W., the American Brass Co., 25 Broadway, N. Y. C.

Pumps Suitable For Every Purpose

100. Large size trash pumps, propeller pumps, angle-flow pumps—a type suitable for every service. A separate bulletin for each is furnished by Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.

SNOW FIGHTING

For High-Speed Snow Removal

44. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow, Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

Chemical Stops Salt Corrosion

114. A new chemical has been developed which, when mixed 1 pound to 100 pounds of salt, prevents any corrosion of automobiles by the salt. Harmless; colorless; odorless. Permits free use of salt for ice and snow control without complaint by drivers. Calgon, Inc., Pittsburgh, Pa.

WATER WORKS

Eliminate Taste and Odor From Your Water

53. Technical pub. No. P.W. 213 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with Break-Point Chlorination. Send free to any operator requesting it.

Chem-O-Feeders for Automatic Chemical Feeding

60. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation, treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. %, 96 Codding St., Providence 1, R. I.

How Elevated Water Tanks Can Save on Operating Costs

14. Beautiful new booklet on Horton elevated steel water tanks suggests ways to reduce pumping costs, increase capacity of systems, maintain uniform pressure, etc. Illustrates 7 models of welded, ellipsoidal-bottom, elevated steel tanks in full color. Write Chicago Bridge & Iron Co., 2115 McCormick Bldg., Chicago 4.

A New Answer to Some Old Waterworks Problems

12. That is what they call "Hypo-Chlorination of Water," a 48-page illustrated discussion of this live subject, in a booklet packed with helpful information. For your copy, address: Mathieson Chemical Corp., Dept. PW, 60 E. 42nd St., New York 17, N. Y.

Have You a Water Conditioning Problem?

56. Installation-tested equipment for complete municipal and industrial systems or individual units. Illustrated and described in latest booklets from Dept. P.W., American Wells Works, Aurora, Ill.

Hydraulic Pipeline Scraper For Water and Sewage Mains

59. For a copy of this compact folder on a hydraulic pipeline scraper which cleans all kinds of mains from 4 inches to 14 inches write to Dept. PW, Carver-Stimpson Pipe Cleaning Co., Walters, Okla.

Helpful Data on Hydrants

64. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Dept. P.W., Anniston, Ala.

Flow Meters With Many New Features

91. The new Propelflo meter for main-line metering introduces many new features you will want to look into. Send for latest bulletin today. Builders Providence, Inc., 16 Codding St., Providence 1, R. I.

Well Water Systems Built to Last

105. Layne pumps are built for wells ranging from 4" to 36" diameter and in capacities from 50 to 16,000 gpm. Full engineering data and many installation views are given in 32 page Pump Bulletin 4-42. Layne and Bowler, Inc., Memphis, Tenn.

Pressure Pipe That Retains Capacity

106. Several bulletins describing the construction of pressure pipe, list of installations, carrying capacity tests, making service connections under pressure; and detail descriptions of several installations. Lock Joint Pipe Co., P.O. Box 269, East Orange, N. J.

Pipe That Is Immune to Tuberculation and Corrosion

104. Transite Pipe. The high strength and low weight of pipe moulded under pressure from asbestos fibre and cement, together with its immunity to tuberculation and corrosion is the subject of a 32-page pamphlet. Johns-Manville, Box 290, New York 16, N. Y.

You Can Depend On These Valves

112. Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 30"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

Tested Jointing Materials

102. "Hydrotite" is a self-caulking, self-sealing joint compound for bell and spigot pipes. For data book and sample write Hydraulic Development Corp., 50 Church St., New York, N. Y.

TO OBTAIN THESE BOOKLETS USE COUPON ON PAGE 77

BRIEFS OF USEFUL BOOKLETS

These are available from the publisher or by using coupon on page 77.

Contractors' Pumps.—A 16-page bulletin describing a complete line of self-priming centrifugal contractors' pumps shows by "x-ray" pictures what goes on inside the pumps. How to select pumps for your particular job; valuable engineering data. Ask for bulletin 8CP-11. Gorman-Rupp Co., Mansfield, Ohio.

Uniform Traffic Devices.—A new edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways" has been published by the Public Roads Administration and is on sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at 50¢ per copy.

Hydraulic Standards.—The 8th edition, revised, of a well-known and valuable text. Six sections: General, Data, Centrifugal Pumps, Rotary Pumps, Reciprocating Pumps, and Pipe Friction. $3. Hydraulic Institute, 90 West St., New York 6, N. Y.

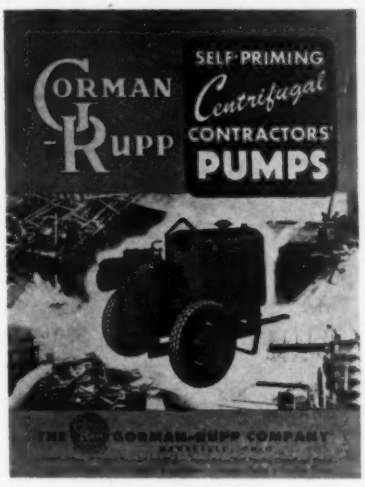
Hypo-Chlorination of Water.—A revised and enlarged edition of a well-known book. New features include discussions of the hypochlorite-activated sodium chlorite process, analytical methods of residual chlorine determination, and new methods of pipe line sterilization. Sent on request to Mathieson Chemical Co., 60 East 42nd St., New York 17, N. Y.

Planning the Modern Municipal Report.—In 44 pages, well illustrated, are presented the basic factors that should be considered in preparing the municipal report. Outstanding types of graphs and charts are shown as well as samples of condensed; simply written reports. This excellent guide will be sent on written request without charge. Address Advertising Department, The Mead Sales Co., 230 Park Ave., New York 17, N. Y.

Meter Reading Practice.—This is a good text book with which to review your meter reading and billing practices. It contains 32 pages and describes latest approved practices in handling meter records. Ask for a copy from H. B. Matheny, Systems Division, 315 Fourth Ave., New York 10, N. Y.

Community Housing.—This booklet, "Housing America," presents an analysis of housing problems and also a solution. It is concerned mainly with mass housing, for which it suggests adequate utility services. A study of a community development of 15,900 homes includes a detailed engineering analysis of the recommended central heating system and compares the cost with individual units. The data presented should be in every engineer's files. Write on business stationery to Ric-Wil Co., Dept. H, Cleveland, Ohio.

Sterelators.—A booklet and special sheets describe Everson Sterelators, also the Evon rota-meter series, the airo-matic gas sterelator, and the napierian meter series. These cover a wide range of capacities, from very small to very large, and are suitable for most any condition of installation. Everson Mfg. Corp., 214 W. Huron St., Chicago 10, Ill.



Cover of new Gorman-Rupp catalog.

Convention Data

New Jersey Section, AWWA.—A luncheon meeting will be held at the Essex House, Newark, N. J., Feb. 17. The annual outing and inspection will be at Wanaque, N. J., June 23. The annual meeting will be held at the Madison Hotel, Atlantic City, Nov. 17 to 19.

Highway Engineering Conference.—A conference for city, county and state highway engineers will be held at Ohio State University, Columbus, Jan. 24 to 26. Joint sponsors are the Department of Civil Engineering of the University and the Ohio Highway Department. R. J. Lehman of the Highway Department can supply further information.

New Jersey Sewage Works Ass'n.—The 34th annual meeting of this association will be held at the Stacy-Trent Hotel, Trenton, N. J., March 23-25. M. S. Kachorsky, Box 283, Manville, N. J., is secretary.

International Civil Engineering Congress.—The first annual meeting of this association will be held in the Palace of Fine Arts of the City of Mexico, April 30 to May 7. Information in detail can be obtained from the General Organizing Committee, Plaza de la Republica 55, Room 606, Mexico, D. F.

Consulting Engineers

George A. Nash, Thomas W. Cadmus and Edward M. Voelker have formed the firm of Nash, Cadmus & Voelker to advise on and handle all phases of waste disposal by incineration, including the disposal of garbage, rubbish, fumes, and pathological, anatomical and industrial wastes. Offices are at 45 West 45th St., New York 19, N. Y. All of the members of the new firm were formerly with Morse Boulger Destructor Co. Mr. Nash was former Manager of General Sales; Mr. Cadmus was General Construction Manager and Assistant Vice-President; and Mr. Voelker was chief engineer. The new firm is highly qualified in the waste collection and disposal field.

Warren W. Clark has opened an office as consulting engineer in the Pacific Building, Salem, Ore., and will specialize in structures, water works, sewerage, streets and pavements. Mr. Clark, who is a brother of Lloyd K. Clark, frequent contributor to PUBLIC WORKS, and well-known sanitary engineer, was with the Ordnance Department during the war and served in the Pacific, like his brother.

Charles R. Velzy has joined with Nussbaumer & Clarke, Inc., Buffalo, N. Y., to form the consulting firm of Nussbaumer, Clarke & Velzy, Inc. Mr. Velzy will be in charge of the New York office of the firm which is located in Room 602, 52 Vanderbilt Ave., New York 17, N. Y.

Robert J. Schatz, formerly of the Pennsylvania Department of Health, E. J. Haneman and J. H. Brendlen have joined the sanitary engineering staff of Gilbert Associates, Inc., Reading, Pa. Mr. Schatz will be in the Reading office, primarily on industrial waste and sewage treatment and Mr. Haneman and Mr. Brendlen will be located in the newly opened Houston, Texas, office.

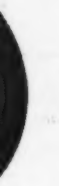
H. A. Stepleton has opened an office in the Spitzer Bldg., Toledo, Ohio, and will act as consulting sanitary engineer. Mr. Stepleton has had a distinguished record in this field since 1925, when he was graduated from Purdue. He will specialize in water supply and treatment, sewerage and sewage treatment and refuse disposal.

Girard Wheeler, formerly chief of the Subsurface Exploration Section of the New York City Department of Public Works, has joined the staff of the Giles Drilling Corp., 21 Park Ave., N. Y., as engineering geologist.

Personal Mention

C. B. Johnson has been made chief engineer and E. R. Gilmore director of research for the Pittsburgh Equitable Meter Division of the Rockwell Mfg. Co.

Neal R. Fosseen, president of the Washington Brick & Lime Co., Spokane, Wash., has been elected representative of the Pacific Coast region on the board of directors of the National Clay Pipe Mfrs. Ass'n.



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